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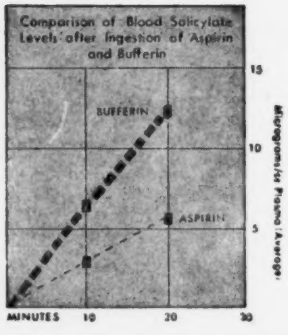

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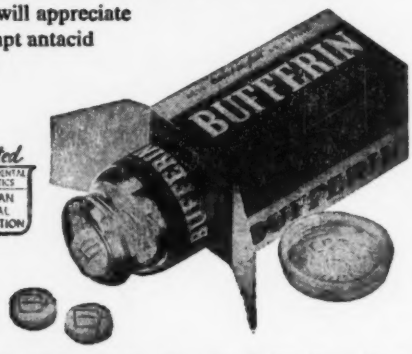

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JOURNAL OF ORAL SURGERY

Fred A. Henny, D.D.S., Editor
HENRY FORD HOSPITAL, DETROIT

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Vertical osteotomy in the mandibular rami for correction of prognathism

■ *Jack B. Caldwell,* D.D.S., M.Sc., and Gordon S. Letterman,† M.D., Washington, D. C.*

An operation for the correction of mandibular prognathism has been developed which produces ideal results for patients with extreme deformity. It is accomplished by vertical osteotomy in the mandibular rami. Results are so uniformly good that a report of the procedure is considered appropriate at this time.

Numerous operations for the correction of prognathic deformities of the mandible have been described. Jaboulay and Bérard[1] proposed osteotomy at the neck of the condyloid process in 1898. Smith and Johnson[2] suggested the removal of a "parallelepipedonal" section of bone from the region of the sigmoid notch and osteotomy at the neck of the condyloid process to permit the correction of prognathism by repositioning the coronoid process posteriorly to the neck of the condyloid process. Section through the neck of the condyloid process by blind passage of a Gigli saw is preferred by some surgeons. Malunion of the segments with the mandible in corrected relation occurs in some instances, whereas a pseudarthrosis results in other cases.

Blair,[3,4,5] who was a pioneer in the surgical correction of prognathism and other deformities of the mandible, proposed the principle of horizontal osteotomy above the mandibular foramen and ostectomy in the body of the mandible. In

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1. Jaboulay, M., and Berard, L. Traitement chirurgical du prognathisme inferieur. Press med., No. 30:173 April 9, 1898.

2. Smith, A. E., and Johnson, J. B. Surgical treatment of mandibular deformations. J.A.D.A. 27:689 May 1940.

3. Blair, V. P. Operations on the jaw-bone and face. Surg., Gynec. & Obst. 4:67 Jan. 1907.

4. Blair, V. P. Underdeveloped lower jaw with limited excursion; report of two cases with operation. J.A.M.A. 53:178 July 17, 1909.

5. Blair, Vilray P. Instances of operative correction of mal-relation of the jaws. Internat. J. Orthodont. 1:395 Aug. 1915.

attempts to overcome objectionable sequelae, such as open bite, nonunion, malunion, nerve injury and external scarring, others suggested variations of the original operations. Kazanjian[6] described a method of osteotomy on a horizontal plane above the mandibular foramen in which he made the bone incisions on a bevel so that greater surface contact of the fragments would enhance bony union. The objection to this procedure, however, is the tendency of the fragments to override and the resulting vertical shortening of the ramus.

Moose[7] and Sloan[8] advocated an intraoral horizontal osteotomy in the ramus by an open operation whereby more accurate location of the section could be determined. They developed special saws to be used in preference to the Gigli saw. With this intraoral approach, Sloan proposed direct wiring around the sigmoid notch to prevent open bite and nonunion resulting from anterior and upward displacement of the proximal fragment. Skaloud[9] made a similar proposal at about the same time.

Ostectomy in the body of the mandible has been performed by various surgeons at sites from the retromolar region to the canine prominence; however, the favored location is in the second bicuspid and first molar region. New and Erich[10] described a method in which the segment of bone was removed without injury to the inferior alveolar nerve and vessels. Dingman[11] refined the procedure by performing it in two stages. Thoma[12] suggested ostectomy in the body of the mandible by an intraoral approach to avoid external scarring. Scougall and Colvin[13] advocated intraosseous fixation with Kirschner wires to obtain rigid fixation of edentulous mandibles after ostectomy in the body of the bone.

Since Hullihen[14] first reported correction of "elongation" of the jaw, almost every conceivable surgical approach has been tried. Nevertheless, it is only by vertical osteotomy in the rami that most of the objectionable features and disadvantages of other methods have been overcome.

■ *Preoperative Appraisal of Prognathism*

At Walter Reed Army Hospital, the cephalograms and study models mounted on an articulator are the chief diagnostic aids in the selection of a site for surgical correction of mandibular prognathism. The jaw relationship and occlusion attainable in any given case are easily determined from study models.

Paper "cutouts" made from a transparent tracing of the lateral cephalogram are helpful in a critical appraisal of various operations and in the selection of the most desirable surgical procedure for the correc-

6. Kazanjian, V. H. The treatment of mandibular prognathism with special reference to edentulous patients. Oral Surg., Oral Med. & Oral Path. 4:680 June 1951.

7. Moose, S. M. Correction of abnormal mandibular protrusion by intra-oral operation. J. Oral Surg. 3:304 Oct. 1945.

8. Sloan, A. C. Intraoral osteotomy of ascending rami for correction of prognathism. Texas D. J. 69:375 Sept. 1951.

9. Skaloud, Francis. A new surgical method for correction of prognathism of the mandible. Oral Surg., Oral Med. & Oral Path. 4:689 June 1951.

10. New, G. B., and Erich, J. B. The surgical correction of mandibular prognathism. Am. J. Surg. 53:2 July 1941.

11. Dingman, R. O. Surgical correction of developmental deformities of the mandible. Plast. & Reconstruct. Surg. 3:124 March 1948.

12. Thoma, K. H. Oral surgery, vol. 2. St. Louis, C. V. Mosby Co., 1948, p. 1444-1447.

13. Scougall, Stuart, and Colvin, Gordon. Functional retention in preangular resection for malocclusion in protrusion of the mandible. Oral Surg., Oral Med. & Oral Path. 4:695 June 1951.

14. Hullihen, S. P. Case of elongation of the under jaw and distortion of the face and neck, caused by a burn, successfully treated. Am. J. D. Sc. 9:157 Jan. 1849.

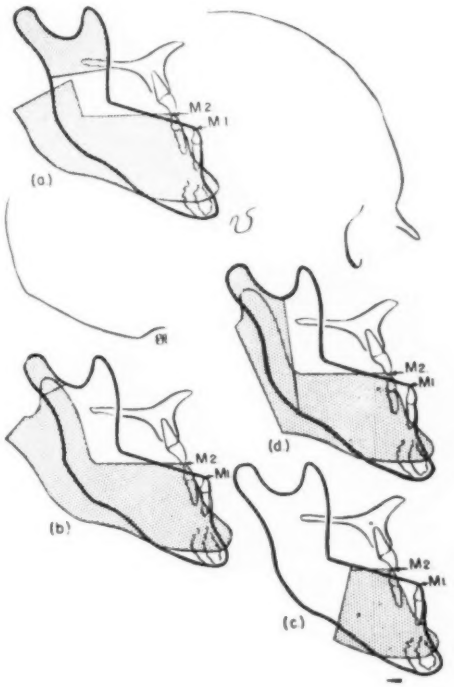

Fig. 1—Comparative study of basic methods and locations for osteotomy and ostectomy to correct extreme mandibular prognathism. Drawings traced from cephalograms of Case 1. a: Horizontal osteotomy in ramus above mandibular foramen (Blair). b: Osteotomy through condyle (Jaboulay and Bérard). c: Ostectomy in body of mandible (Blair, New and Erich, and Dingman). d: Vertical osteotomy in ramus (Caldwell and Letterman)

tion of this deformity. A graphic drawing traced from these "paper cutout mandibles" of the first case presented in this article illustrates one such comparative study of the basic methods and standard locations of osteotomy and ostectomy (Fig. 1, a, b, c). From this survey it was apparent that none of the usual methods were acceptable in this case of extreme deformity.

In repositioning the mandible to proper relation posteriorly, the divergence of the occlusal planes of the mandible (M1) and maxilla (M2) must be considered (Fig. 1). In the preliminary study the condyle was first arbitrarily retained in its original position and the mandible moved to the desired new occlusal relation. With horizontal osteotomy in the ramus above the mandibular foramen (Fig. 1, a), the posterior retrusion of the ramus at the point of section was extreme. Osteotomy through the neck of the condyloid process, with repositioning of the mandible, placed the coronoid process over the neck of the condyloid process; and retrusion of the ramus posteriorly again was too extreme to be acceptable (Fig. 1, b). Neither did ostectomy in the body of the mandible (Fig. 1, c) offer a desirable approach.

Additional "cutouts" were then made to find a location for section which would be suitable. The location was found in a line drawn vertically from the sigmoid notch down through the ramus to the angle of the mandible (Fig. 1, d). An osteotomy made vertically in the ramus offered several advantages in addition to correction of the prognathic deformity. The retrusion of the jaw would not be overextended, the body of the mandible would not be shortened, and a definite angle to the mandible would result.

With this possibility of vertical osteotomy in the rami visualized, the next problem was the method of accomplishing it. Study of the average dry specimen of the mandible reveals a lateral flare of the rami posteriorly and the position of the mandibular foramen in line with, or just anterior to, a line drawn from the sigmoid

notch to the angle of the mandible. It was concluded that a vertical section could be made and the whole mandible moved posteriorly, with the anterior portion of the ramus coming to rest medial to the posterior portion. To prevent lateral displacement or bulging of the posterior portion of the ramus, however, and to promote early union, it was decided that the lateral cortex of the anterior portion of the ramus should be removed. By this procedure, it would be possible also to complete the section without damage to the inferior alveolar nerve, since the section would be made over the mandibular foramen and, in the movement of the mandible backward, this nerve would simply be displaced into the soft structures medial to the bone.

Cephalograms, which have been invaluable in developing this method of operation, are nothing more than ordinary roentgenograms taken in a fixed position at a distance of five feet. Their primary use is in orthodontics for the measurement of growth and development of the teeth and jaws in relation to the rest of the head. Repeat exposures can be made in precisely the same position time after time.[15]

For the purpose of diagnosis in deformities of the jaws, essentially the same result can be obtained with any ordinary general x-ray unit. The primary objective is to expose a true lateral roentgenogram from a greater distance than ordinarily used so that an accurate image will result. The principle is identical to that of long focal-film distance in intraoral dental roentgenography. Therefore, "cephalograms" for surgical purposes are within the reach of anyone who has access to a general x-ray unit.

■ *Description of the Operative Procedure*

The operative procedure for vertical osteotomy in the mandibular rami was sketched by the medical artist while the second operation was being performed. These drawings, which appear in Figures 2, 3 and 4, illustrate the technic. By a submandibular approach through an incision approximately 3 ½ inches long, the lateral surface of the ramus of the mandible is exposed to the sigmoid notch (Fig. 2, b). The mandibular branch of the facial nerve is identified and retracted with the flap. The facial vessels are located, ligated with no. 00 silk, and divided. As the periosteum at the inferior border of the mandible is elevated sharply from the bone, the parotid gland and the masseter muscle are retracted in the flap.

The attachments of the internal pterygoid muscle are detached sharply, and the part of the sphenomandibular ligament which attaches below and posteriorly to the sulcus is elevated. The soft tissue flap is retracted with wide right angle retractors.

The vertical line for osteotomy is marked with methylene blue dye over the mandibular foramen, which can be visualized on the lateral aspect of the ramus by a very slight rounded prominence. With a no. 703 taper fissure bur in a straight dental handpiece, the vertical section is begun by placing a groove in the cortex from the sigmoid notch to a point just anterior to the angle of the mandible (Fig. 2, c). This groove is extended through the

15. Broadbent, B. H. Measurement of dentofacial changes in relation to the cranium. In Practical orthodontics, ed. 7, Anderson, G. M. St. Louis, C. V. Mosby Co., 1948, p. 208-229.

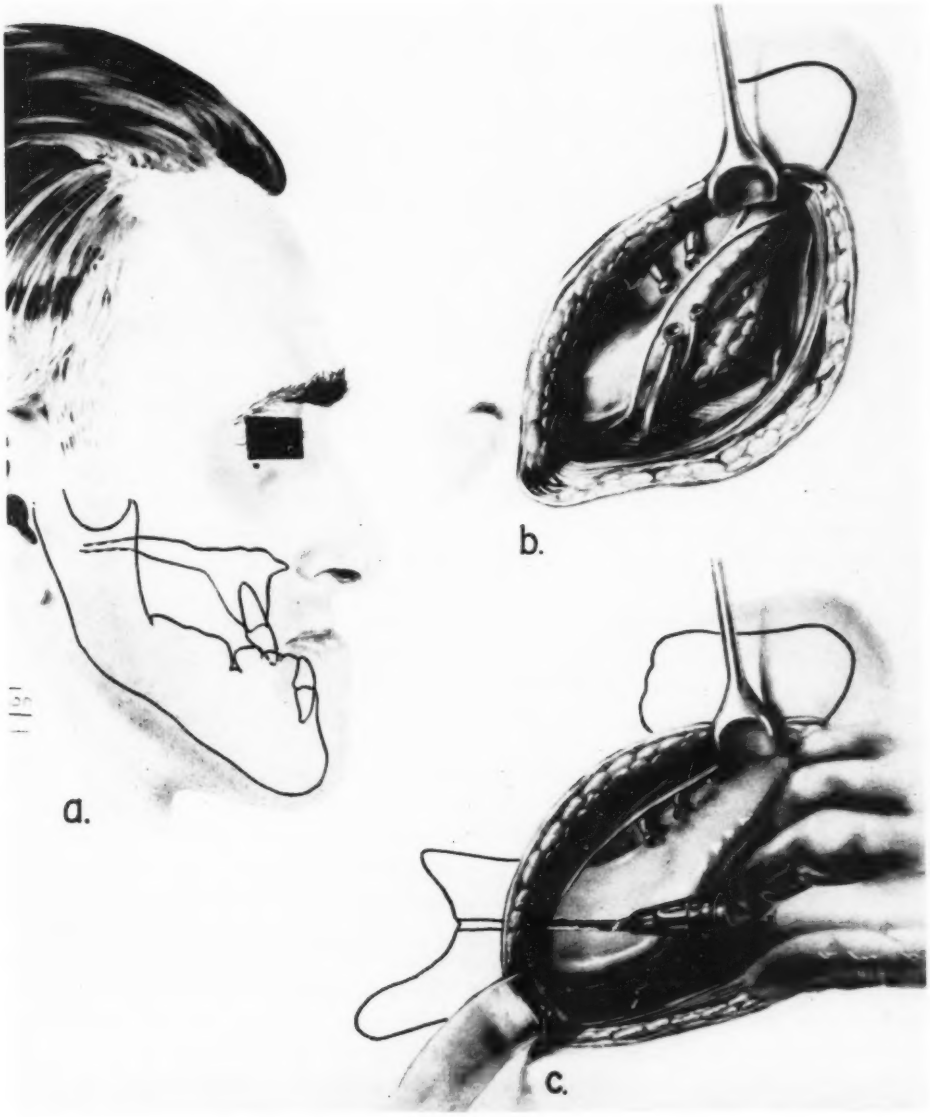

Fig. 2—Operative procedure for vertical osteotomy in ramus. a: Superimposed tracing of cephalogram, illustrating prognathism of Case 2. b: Submandibular surgical approach to ramus. c: Vertical section begun from sigmoid notch to point anterior to angle of mandible, over mandibular foramen

cortex below the mandibular foramen, but extreme care is exercised to avoid penetration of the lateral cortex over the mandibular foramen.

The coronoid process is detached only sufficiently to tip anteriorly with muscle pull but left attached to the anterior border of the ramus by the insertion of the temporal muscle. This procedure is accomplished by placing closely spaced drill holes from the sigmoid notch downward and anteriorly to the anterior border of the ramus. With the coronoid process thus weakened, fracture of the process is completed with a sharp flat bone chisel (Fig. 3, a).

Decortication of the anterior portion of the ramus must be accomplished with caution to avoid injury to the inferior alveolar nerve. With a small (no. 15) bone drill in a straight dental handpiece, numerous penetrations are made through the lateral cortex from the coronoid section to the lower border of the mandible and anteriorly for a distance of approximately 1½ cm., or far enough to accommodate the posterior part of the ramus when it is repositioned (Fig. 3, b). The drill penetrations are not made completely through the cortex over the mandibular canal. These holes are spaced about 3 mm. apart. Thus weakened, the remaining cortical bone is removed with a small, broad, flat chisel (Fig. 3, d). The Stout no. 3 osseous chisel is ideal for this purpose if a long, sharp bevel is provided. The inferior alveolar nerve lies immediately below the cortical plate of bone; it can be exposed in its entire course through the canal by careful excision of bone.

To promote early union of the parts when repositioned, several drill holes are placed completely through the posterior portion of the ramus, since it is impractical to decorticate its medial surface. These drill holes are placed prior to completion of the vertical osteotomy while the posterior portion is still easily controlled (Fig. 3, c).

At this point, prior to completion of the vertical sectioning, the wound is packed with wet sponges; and the patient is turned on the opposite side. The same procedure is carried out, except that the osteotomy is completed.

It is easier to work on the second side if the first side is left intact during the procedure. To complete the section, the groove above the sulcus is deepened; and the lingual cortex—there is practically no medullary bone in this region—is weakened with a few carefully placed drill penetrations that pass through the cortex. A wide periosteal elevator is placed under the medial aspect of the ramus in line with the vertical section, and a no. 703 taper fissure bur is used to complete the section from the mandibular sulcus to the inferior border (Fig. 4, a). This cut is just wide enough to admit a flat periosteal elevator, which is rotated gently to cause fracture in the vertical plane. The inferior alveolar nerve remains intact and uninjured.

With the osteotomy completed on both sides, the wounds are packed, and the field is covered with a sterile towel. The mouth is entered, and the mandible is repositioned posteriorly so that the teeth are brought into normal occlusal relation. Intermaxillary multiple loop wiring should be placed prior to surgery, so that immobilization can be accomplished in a matter of minutes by the application of intermaxillary elastic ligatures.

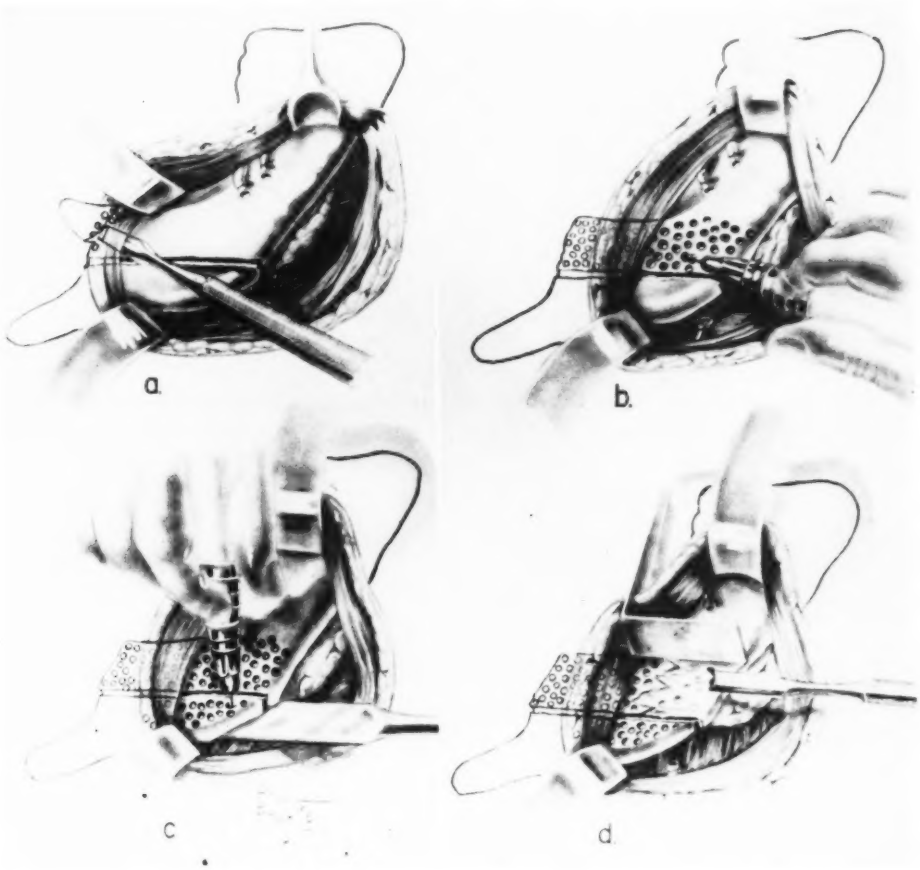

Fig. 3—Operative procedure (continued). a: Drill penetration to weaken coronoid process obliquely from sigmoid notch to anterior border of ramus so that it can be sectioned accurately. b: Drill holes made in lateral cortex of ramus to permit easy excision of outer dense plate of bone. c: Drill penetrations made repeatedly through lateral and medial cortices of posterior portion of ramus to assure early union of sectioned parts in new position. d: Perforated cortical plate of bone excised to expose medullary space of anterior portion of ramus and inferior alveolar nerve and vessels in their canal

After the teeth have been placed in occlusion, the surgeon, who has changed gown and gloves, continues the surgical operation. The posterior portion of the ramus is easily placed onto the decorticated anterior portion, and fixation is accomplished by direct wiring (Fig. 4, b). The sectioned portions of the ramus are held firmly in position with Kocher forceps while drill holes for direct wiring are made. Doubled no. 28 stainless steel wire is threaded through the holes while the

sectioned parts are still held firmly with Kocher forceps. Doubling the wire and directing the blunt, doubled end through the holes facilitates passage of the wire. After passage has been accomplished, the doubled wire is cut apart and each strand turned to an appropriate position and twisted separately. A firm, inlaid joint is thus made and held securely in position.

Closure of the wound is carried out in the usual manner with care being exercised to return the internal pterygoid and masseter muscles to position, so that reattachment can be expected and masticatory function will not be interfered with (Fig. 4, c).

The number of patients receiving this elective type of surgery in the Walter Reed Army Hospital has been limited; the patients who have been treated have had extreme deformity. Regardless of the method of treatment, when standardized technics were employed, many disadvantages were encountered. Several of these disadvantages have been overcome by vertical osteotomy in the mandibular rami.

■ *Case Reports*

CASE 1—A 22 year old Air Force noncommissioned officer who was exceedingly self-conscious about his appearance and worried for fear that he had a "tumor of the jaw" was referred for surgical correction of an extreme mandibular prognathism (Fig. 5, above).

Examination—Physical examination revealed no abnormalities except those connected with the deformity: an obtuse gonial angle of the mandible, an extreme overdevelopment of the mental process and a severe Class III malocclusion. As a result of the malocclusion, the patient had difficulty in the enunciation of certain sounds. The tongue was enormous; its posterior repositioning with the mandible and with other structures of the floor of the mouth could affect the patient's deglutition and respiration and thus create a distinct hazard immediately after surgery, especially with the edema which could be expected in the soft tissues of the oral pharynx.

Therefore, a prophylactic tracheotomy was considered essential. Furthermore, to overcome the anterior pressure of the tongue against the mandible, which would tend to cause it to revert to a protruded relation, a partial glossectomy was planned prior to corrective facial surgery.

Since speech deficiencies might be aggravated by partial glossectomy, a consultation with a member of the speech correction department was held. In the opinion of the speech pathologist, the proposed surgery on the tongue "would not create any speech problems."

The results of laboratory examinations, including hematological examination, serological examination, blood chemistry tests, urinalysis and a chest roentgenogram, were negative or within normal limits. Posteroanterior and lateral roentgenograms of the mandible and a complete periapical dental survey revealed no pathologic condition. Cephalograms of the skull disclosed extreme prognathism of a considerably oversized mandible (Fig. 5, below left). Casual examination of the lateral cephalogram suggested underdevelopment of the maxilla, but further analysis of the roentgenogram proved the maxilla to be normal in size. The mandibular incisors were 17 mm. from normal

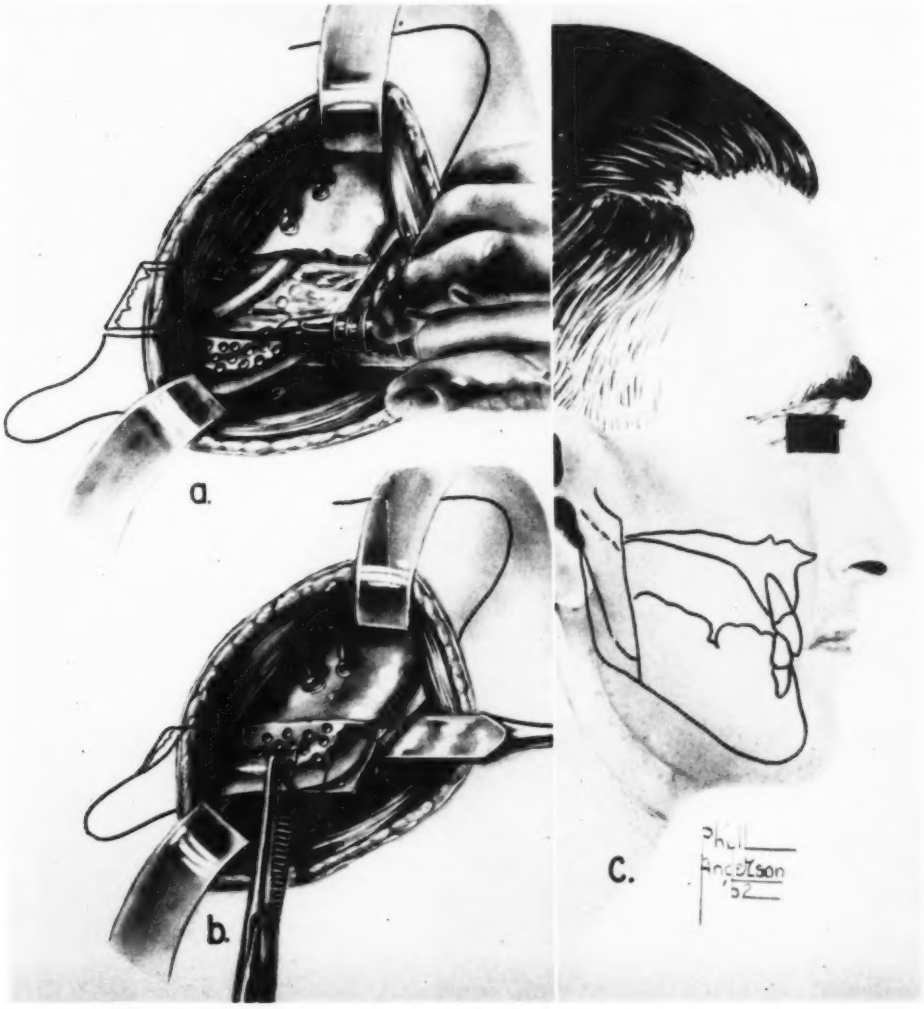

Fig. 4—Operative procedure completed. a: Medullary bone and nerve exposed in anterior portion of ramus; vertical sectioning through medial cortical plate. b: Both sides sectioned completely in vertical plane, teeth occluded in proper relation, and perforated posterior portion of ramus onlaid onto decorticated anterior portion of ramus and wired directly in proper position, without disturbing normal relation in temporomandibular joint. c: Postoperative normal jaw relation

relation with the maxillary incisors. The drawings in Figure 1 were made from tracings of the roentgenogram shown in Figure 5, below left.

Treatment and Hospital Course—On January 17 with the use of a local anesthetic, a prophylactic tracheotomy was performed to insure an adequate airway for the partial glossectomy and osteotomy. One week later, a wedge was excised from the tip of the tongue to reduce its length by approximately ¾ inch.

Cast labial arch splints were constructed prior to osteotomy. These are used when movement of teeth is to be prevented during protracted intermaxillary fixation. The splints were inserted on February 27, 1952; and on February 28, with the use of a general anesthetic, a bilateral vertical osteotomy of the rami of the mandible was performed. The immediate postoperative course was complicated by considerable swelling and the patient's inability to swallow. Nutrition and fluid requirements were provided by intravenous infusions and nasal tube feeding for four days; after this period a normal intake by the oral route was possible.

By the end of the first week after the

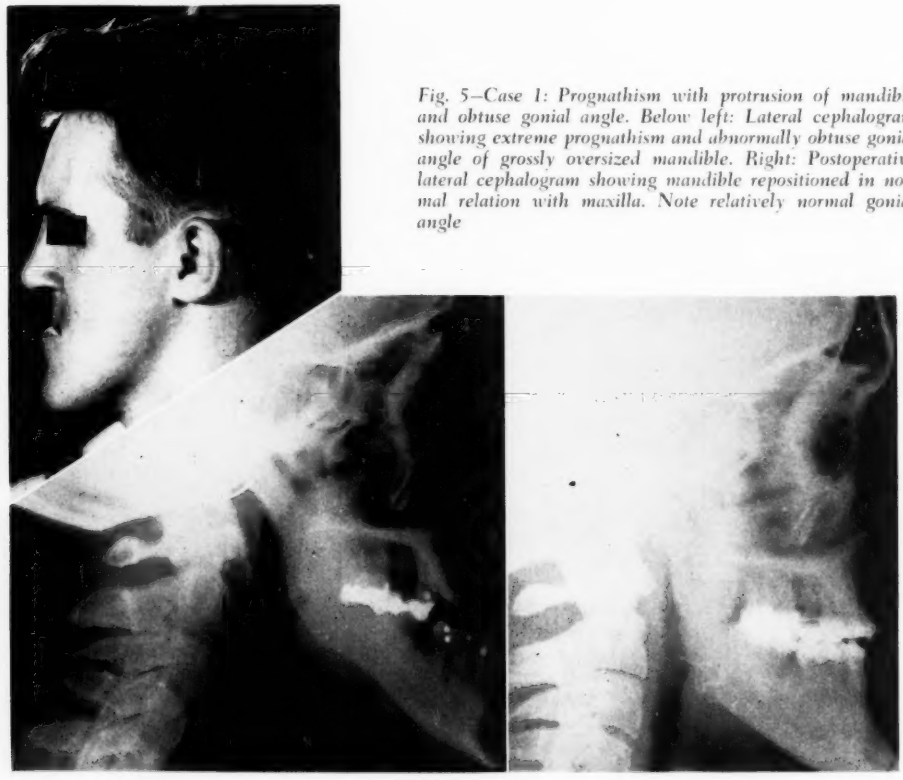

Fig. 5—Case 1: Prognathism with protrusion of mandible and obtuse gonial angle. Below left: Lateral cephalogram showing extreme prognathism and abnormally obtuse gonial angle of grossly oversized mandible. Right: Postoperative lateral cephalogram showing mandible repositioned in normal relation with maxilla. Note relatively normal gonial angle

operation, all swelling had subsided, and the tracheotomy tube was removed. Five weeks postoperatively, the intermaxillary elastics were removed, and the patient's jaw was allowed to function. The patient was able to open his mouth to 18 mm. immediately. By the end of the sixth week, there was no doubt that solid bony union was occurring, and the splints were removed. Three weeks after the intermaxillary fixation appliances were removed, the patient was able to open his mouth 35 mm. and had unimpaired lateral and protrusive movements of the jaw. The patient has been maintained on an outpatient status and examined regularly since his discharge from the hospital.

The staff orthodontist started correction of the postsurgical malocclusion three months after surgery. When the patient was seen by the speech therapist nine months after surgery, he noted that "former defective sibilants s, z, ch and sh had been corrected by surgery." Also at that time—nine months after surgery—the patient had completely normal function and could open his mouth to 45 mm. He had no temporomandibular joint discomfort, and roentgenograms revealed normal joint relation and function.

For several months after surgery, he had difficulty controlling his lower lip, since it had become overdeveloped because of the effort involved in closing his lips over the protruding mandible. This condition was overcome, and additional surgery was not necessary. There never was any evidence of facial nerve paralysis. There was, however, paresthesia of the lower lip for about two weeks postoperatively; the rapid return of sensation after that time indicated that damage to the inferior alveolar nerve was minor. Final cephalograms disclosed relatively normal skeletal contours and jaw relation (Fig. 5, below right).

No expansion or bulging laterally was observed when preoperative and postoperative posteroanterior cephalograms were compared (Fig. 6, above). This result can be attributed to the normal lateral flare of the mandible posteriorly and to the inlay mortising of the sectioned parts when they were repositioned. A normal angle of the mandible was produced at the same time that the protrusion was corrected (Fig. 6, below). The fullness of the patient's face is due to the fact that he gained approximately 25 pounds after improvement of his occlusion.

Close attention to the immediate postoperative course is essential. Because of the extent of the surgery and the new posterior position of the mandible and the structures of the floor of the mouth, an unimpaired airway is the primary consideration.

The use of the dental drill in accomplishing this type of surgery and the need for intermaxillary fixation of the teeth should govern the selection of the anesthetic for this operation. The explosion hazard, created by the use of the dental drill in the presence of certain gaseous agents, and the induction of nausea with vomiting during the recovery period should be avoided.

CASE 2—A 23 year old Air Force noncommissioned officer was admitted to Walter Reed Army Hospital August 18, 1952, because of difficulty in wearing an oxygen mask and inability to masticate food normally on account of extreme man-

dibular prognathism and malocclusion (Fig. 7, above left). His past history was not significant.

Examination—Except for extreme deformity of the mandible, results of the physical examination were negative. There was a severe Class III malocclusion; but the teeth were in good repair, and oral hygiene was satisfactory.

The results of laboratory examinations were negative or within normal limits. Posteroanterior and lateral roentgenograms of the mandible revealed nothing significant, and a complete periapical dental survey gave no evidence of any pathological dental conditions. Cephalograms of the skull revealed extreme prognathism with the protrusion of the mandible measuring approximately 14 mm. (Fig. 7, below left). Drawings in Figures 2, 3 and 4 were made from tracings of the lateral cephalogram shown in Figure 7, below left.

Preoperative analysis of the abnormality was accomplished by methods similar to those used in Case 1. From examination of study models it was determined that excellent jaw relation and acceptable occlusion could be attained by an operation in the rami. By the use of "paper cutouts" made from the transparent tracings of the lateral cephalograms, vertical osteotomy in the rami was visualized and the rami determined to be the best location for the surgical correction.

Treatment and Hospital Course—Prior to surgery, intermaxillary multiple loop wiring was applied to the teeth. On September 2, 1952, with anesthesia induced by thiopental sodium administered intravenously and supplemented by nitrous oxide and oxygen supplied by means of an endotracheal tube, bilateral vertical osteotomies in the mandibular rami were performed.

There were no serious operative or immediate postoperative complications; however, fluid intake by intravenous infusion was necessary during the first two postoperative days because of difficulty in swallowing. At no time was there respiratory difficulty.

There was no notable motor or sensory nerve damage following surgery. The intermaxillary elastic ligatures were removed on the twenty-sixth postoperative day, and the patient was permitted unrestricted function and placed on a regular diet. There was no mobility of the sectioned part demonstrable by manipulation. Thereafter, no shifting of occlusion was noted, and five weeks after surgery all wiring was removed. Minor equilibration produced normal functioning occlusion.

When the patient was discharged from the hospital, the mouth opening measured 25 mm. At the follow-up examination three months after surgery, the mouth opening had increased to 35 mm., and the patient had normal lateral and protrusive excursions of the mandible. There appeared to be no temporomandibular joint disturbance resulting from surgery. The occlusion was normal and comfortable. There was roentgenographic evidence of bony union. Cephalograms, compared with those of the immediate postoperative examination, disclosed no change or shifting of the mandible. Normal facial skeletal contour was evident (Fig. 7, below right), and the cosmetic result was gratifying (Fig. 7, above right).

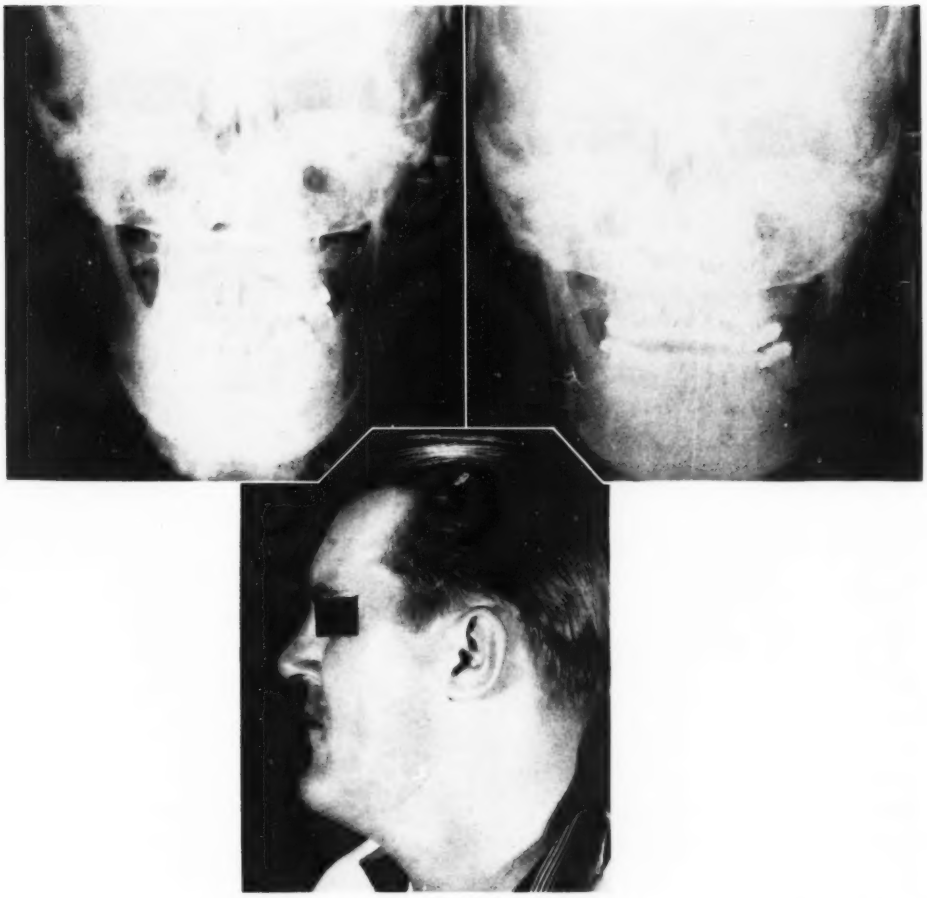

Fig. 6—Case 1. Above: Preoperative and postoperative posteroanterior cephalograms showing no change in lateral dimensions of jaw. There is no bulging of rami after the operation. Below: Postoperative view showing normal profile and corrected angle of jaw. Surgical scar is not noticeable

CASE 3—A 23 year old noncommissioned officer was admitted on September 2, 1952. His chief complaint was that of inability to masticate food properly because of malocclusion, loss of teeth and unsatisfactory prosthetic appliances. The patient's prognathism is shown in Figure 8, above left.

Examination—The physical examination revealed only extreme mandibular prognathism and associated dental defects which contributed to the patient's complaints. The results of the laboratory examinations were negative or within normal limits.

Clinical and roentgenographic exam-

inations of the teeth and jaws disclosed evidence of periapical infection involving the lower right central incisor and second bicuspid. There was an impacted lower left second bicuspid and a malposed first bicuspid. Of significance was the absence of the lower right molar teeth. Other defects, except for restorable carious teeth, were not significant.

From cephalograms and study models, it was estimated that a correction of approximately 15 mm. was necessary. In

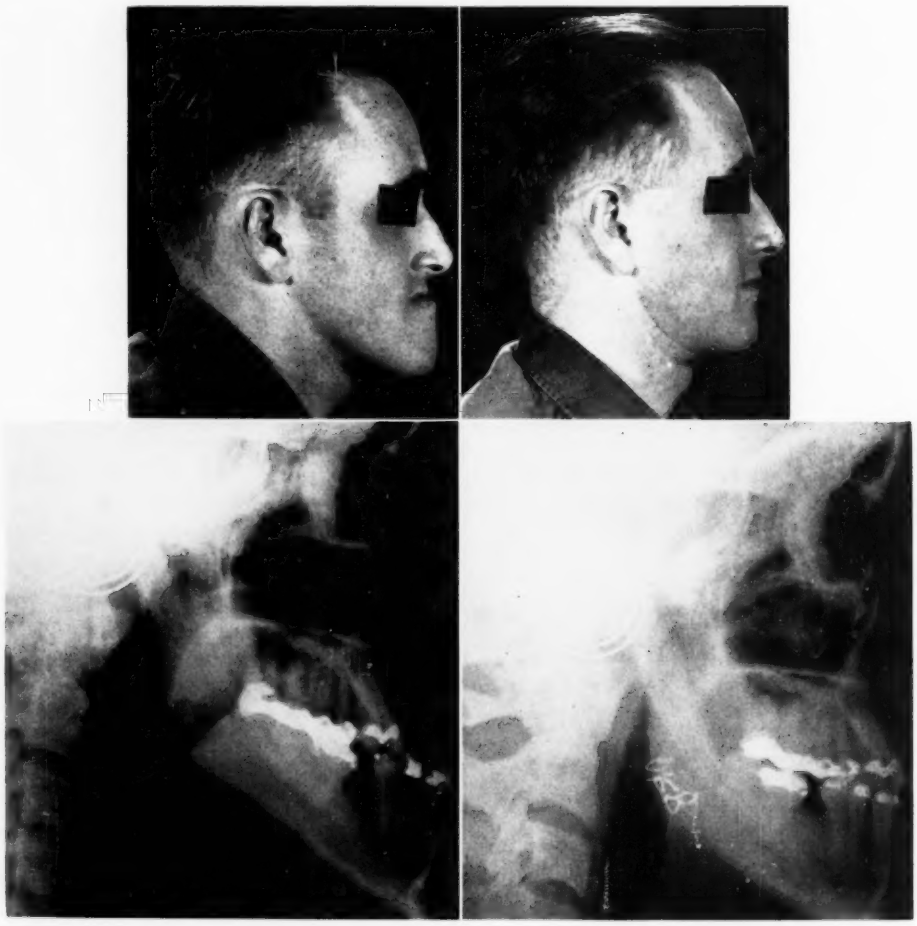

Fig. 7—Case 2. Left above: Preoperative view showing prognathism with protrusion of mandible and obtuse gonial angle. Left below: Lateral cephalogram showing extent of prognathism and obtuse gonial angle. Right below: Postoperative lateral cephalogram showing normal facial skeletal contour and jaw relation. Right above: Postoperative view showing gratifying cosmetic results

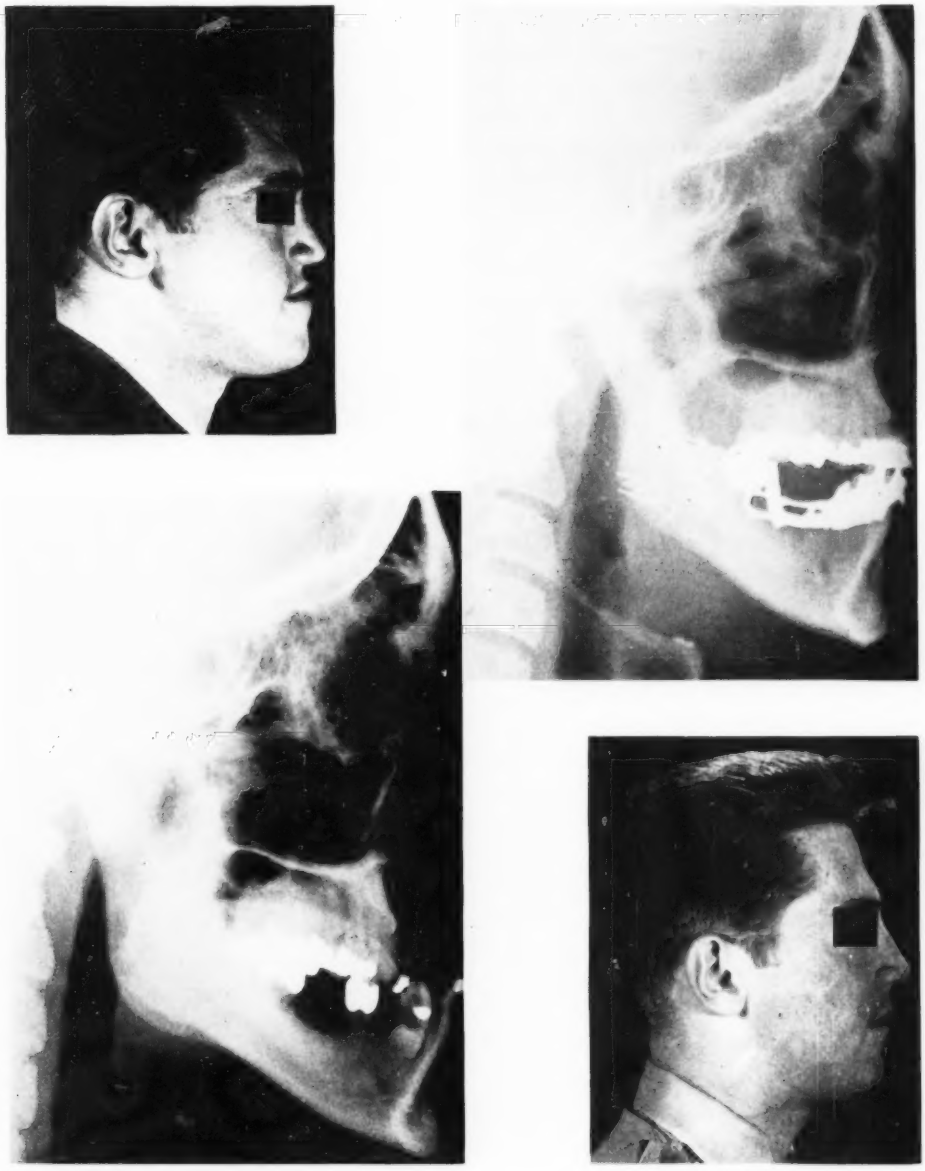

Fig. 8—Case 3. Above left: Preoperative view showing deforming prognathism, requiring correction of 15 mm. Below left: Lateral cephalogram showing extent of prognathism. In contrast to most cases, there is a prominent normal gonial angle. Above right: Postoperative lateral cephalogram showing normal skeletal contour and jaw relation. Prominent gonial angle is retained as well as vertical relation on edentulous side. Below right: Postoperative view showing improvement in appearance

contrast to most deformities of this type, there was a normal prominent gonial angle of the mandible (Fig. 8, below left).

As in the previous two cases, the rami afforded the best site for the operation, and vertical osteotomy was the preferable method.

Treatment and Hospital Course—Prior to surgery, the periapically involved lower right central incisor and the second bicuspid were extracted. On September 25, 1952, intermaxillary multiple loop wiring was placed on the opposing remaining teeth.

On September 26, 1952, with anesthesia induced by thiopental sodium administered intravenously and supplemented by nitrous oxide and oxygen supplied by means of an endotracheal tube, the deformity was corrected by vertical osteotomies in the mandibular rami. In this case the coronoid processes were detached obliquely downward and anteriorly from the sigmoid notch, but the insertion of the temporalis muscle was not disturbed. The result was that as the mandible was moved posteriorly after the vertical section, the coronoid processes tipped anteriorly in the manner of a hinge but were not completely detached or removed as in Cases 1 and 2. This procedure is probably the best solution to the question of management of the coronoid process.

The immediate postoperative course was uneventful, and the patient was able to take liquids by mouth on the first postoperative day. There was no motor nerve weakness following surgery, but there was partial paresthesia of the inferior alveolar nerve as evidenced by a tingling of the lower lip. Numbness was incomplete, and the patient responded to sharp stimulus on the labial aspect of the anterior portion of the alveolus.

The intermaxillary fixation, consisting of elastic ligatures, was removed 25 days postoperatively. Mobility of the sectioned rami was not demonstrable clinically; and when no movement or change in occlusion had occurred one week later, all wiring was removed. On the thirty-fifth postoperative day, the patient could open his mouth to 28 mm. After extraction of the impacted and malpositioned lower left bicuspids, he was referred for restorative dental procedures.

An upper anterior fixed bridge and a lower partial denture were provided to complete the correction of all abnormalities and dental defects. Functional and cosmetic results were excellent. The patient had a full range of motion in all excursions of the mandible and could open his mouth to 50 mm. when he was seen on follow-up examination nine months after the operation. There was no residual sensory nerve anesthesia. Skeletal contour was normal (Fig. 8, above right), and there was a definite improvement in appearance (Fig. 8, below right).

Worthy of special comment is the fact that vertical relation, that is, denture space, of the right side of the mandible was maintained during surgery and during the postsurgical healing period by this method of osteotomy and direct interosseous wiring. Sufficient immobilization of the jaws also was secured to insure union by the use of minimal intermaxillary wiring; and because of the short time necessary for immobilization, the few teeth in the appliances were uninjured.

■ *Conclusions*

Among the many advantages of vertical osteotomy in the mandibular rami are the following:

1. The method is especially applicable in cases of prognathism where correction must exceed 10 mm.

2. Interdental fixation is needed for a minimal period of three to five weeks to obtain clinical union.

3. Because of the short period of interdental fixation, teeth are undamaged by protracted stress; and extrusion does not occur.

4. Elaborate orthodontic appliances or splints are not needed for fixation. Simple intramaxillary multiple loop wiring will suffice.

5. No special saws or other special instruments are needed.

6. The condyle remains in normal relation to the glenoid fossa, the joint is placed in function in three to five weeks, and thus possible subsequent temporomandibular joint problems are eliminated.

7. Injury to the inferior alveolar sensory nerve can be completely avoided; but if it is incurred, the paresthesia is temporary.

8. Injury to the mandibular branch of the facial motor nerve may occur as a result of too forceful retraction of the soft tissues, but paralysis is transitory.

9. Vertical dimension, or denture space, is preserved or may be increased slightly by direct interosseous wiring on the vertical plane.

10. The body of the mandible is not shortened anteroposteriorly, as in ostectomy, and thus the prosthodontist does not have a prosthetic problem later.

11. An excellent cosmetic result can be produced in every case. There is no open bite deformity, as there frequently is as a result of other operations in the ramus. A definite angle to the mandible is produced. The characteristic obtuse angle of prognathic deformity, which remains after ostectomy in the body of the jaw, is eliminated.

The disadvantages encountered in this operation are few but must be pointed out:

1. The operating time is long; five and a half hours was required in each of the first two cases. This time was cut to four and a half hours in the third case, and can be reduced even further; however, four to four and a half hours is expected to be the average operating time.

2. The hazard accompanying any major surgical procedure in the neck is present in this operation. The operator must be prepared to assure an adequate airway immediately after the operation and to supply nutrition for two or three days.

3. External scarring is considered objectionable by some; however, if the incision is properly placed and if the wound is properly closed, within six months scarring is so minimal that it cannot even be considered as a disadvantage.

Application of the principle of vertical osteotomy in the rami to the correction of other developmental or acquired deformities of the mandible has many possibilities:

1. It should be an ideal method for the correction of prognathism in edentulous patients (see Case 3).

2. A modification of the operation should make possible the correction of

micrognathic mandibles with advantages similar to those resulting from correction of prognathism.

3. Deformities in the ramus resulting from trauma or infection, which have caused shortening of the ramus, can be corrected by vertical sliding osteotomy to produce elongation of the ramus.

■ *Summary*

An operation for the correction of mandibular prognathism has been developed, which is recommended especially for cases of extreme deformity. The three case reports illustrate the practical application of the procedure and the uniformly excellent results obtained.

By extraoral submandibular approach, a vertical osteotomy is performed in the rami of the mandible from the sigmoid notch downward over the mandibular foramen to the lower border of the mandible just anterior to the angle. By decortication and mortising of the sectioned ramus, close approximation is obtained; interosseous wiring assures clinical union —and with it resumption of function— within four weeks.

Many disadvantages encountered in other methods of correction of the deformity are overcome by this operation, and functional and cosmetic results produced are superior to those achieved by other methods.

An improved intracoronal method of intermaxillary fixation

■ *Sterling G. Mead,* D.D.S.; George D. Selfridge,† D.D.S., and Homer S. Samuels,† D.D.S., Jacksonville, Fla.*

The utilization of a device secured in a tooth or teeth is not new; its use has been minimal, however, chiefly because of the main disadvantage of the older intracoronal technics; namely, the length of time necessary for preparing and casting an inlay type retainer. It is hoped that the method presented in this article, an intracoronal method of obtaining fixation for intermaxillary reduction and immobilization, will make this type of procedure practical and desirable in selected cases.

The main advantage of the modified technic is the ease and rapidity with

The opinions or assertions contained in this article are the private ones of the writers and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.

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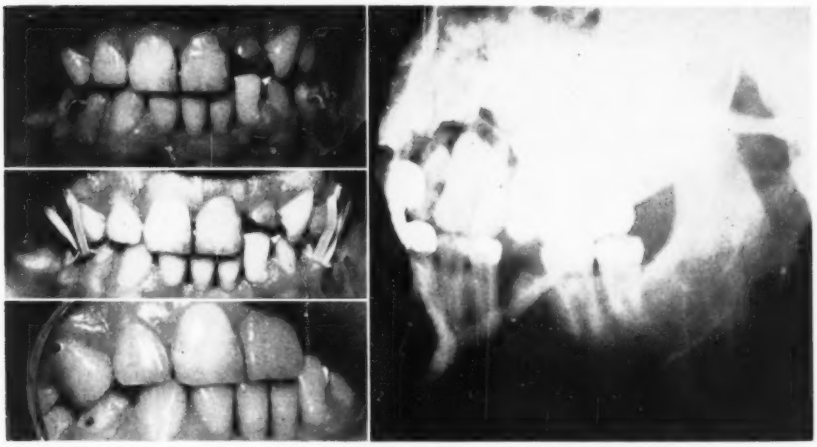

Left above: Pins seated in prepared cavities. Left center: Rubber ligatures applied. Left below: Pins cut off and burnished. Right: Preoperative roentgenogram of right side of mandible, showing fracture in bicuspid region

which an intracoronal pin can be utilized for certain fractures of the mandible and the maxilla. This procedure consists of the following steps:

1. The tooth (or teeth) with the greatest positional advantage for reducing the fracture or fractures (illustration, left) is selected.

2. With an inverted cone diamond stone, a small niche is broken in the enamel at the junction of the middle and cervical thirds of the buccal surface of the tooth selected.

3. Next, with a no. 701 tapered fissure carbide bur, a hole is drilled perpendicular to the long axis of the tooth for a distance of 1.5 mm. The distance can be marked or gauged on the bur for accuracy. This depth is sufficient at the site suggested for the retention of gold pins and yet allows for a margin of safety in any adult tooth.

4. A no. 18 gauge gold alloy wire has already been cut and bent to form a tiny hook. This hook is exactly the right size to fit the opening of the no. 701 bur hole snugly. The hook is inserted into place (illustration, left above) under pressure with a pair of pliers or a hemostat. Each tooth is prepared in the same manner.

Rubber loops are passed around the inserted pins for traction and immobilization (illustration, left center) in exactly the same manner as this step is carried out in other methods. At the close of the procedure, the gold pins can be cut flush with the enamel and smoothed with a stone bur and other burnishers to the desired finish (illustration, left below); or if the pins are found to be insecure when the ligatures are removed, they can be taken out, and the cavity can be enlarged to receive any of the conventional filling

materials. Then the polishing is done in the usual manner to obtain the necessary surface finish. The end result is a very small, accurately fitting inlay, amalgam filling or silicate restoration.

■ *Report of Case*

A 27 year old white man was admitted to the U. S. Naval Hospital, Jacksonville, Fla., on April 21, 1953. The diagnosis on admission was bilateral fracture of the mandible.

Roentgenographic examination revealed a complete fracture in the right bicuspid region with some medial displacement and in the left side of the mandible a subcondylar fracture with lateral displacement of the superior fragment (illustration, right).

Clinical examination revealed a malocclusion resulting from the unreduced fractures and also crepitation on palpation. There was moderate edema and discomfort.

The intracoronal pin fixation method was considered adequate for reduction and immobilization of the fracture. The procedure as outlined in this article was carried out on the second day after admission. Reduction, immobilization and progress were uncomplicated. The ligatures were removed on May 27, and the cavities which were prepared to receive the gold pins were restored in the manner already described. The patient was discharged on May 29, 1953.

■ *Advantages of Modified Procedure*

1. The technic is simple, and its application requires a minimum of time.
2. The technic involves comparatively little damage to periodontal tissues.
3. The technic is particularly useful in those cases where the contour and position of a key tooth or teeth make other methods of intermaxillary procedure difficult.

■ *Summary*

The improved technic of intracoronal fixation presented in this article can be used in any case where intermaxillary wiring seems desirable. It can be used also in certain cases where other conventional methods are not successful. The technic is a simple, effective method; the time required for its application compares favorably with that required for other methods. This method is particularly useful in selected cases for dentists who are not experienced in "wiring" technics; it should be useful also for the oral surgeon whether it is employed alone or used in combination with one or more of the various other technics of reduction and immobilization.

■ Words as Instruments

The use of language can become an instrument of health and joy just as its abuse can act as a vehicle of discouragement and misery. We can strike with a word sometimes more effectively than with the fist; by words we can help and hurt, inspire and dishearten, give value to a matter or throw it into oblivion.—*William G. Niederland, Man-Made Plague: A Primer on Neurosis.*

Metastatic carcinoma of the mandible

■ *Wilbur C. Moorman,* D.D.S., M.S., and William G. Shafer,† D.D.S., M.S., Indianapolis*

For a number of years occasional articles and case reports have appeared in the literature concerning metastatic carcinoma of the mandible, and the majority of these papers emphasize the extreme rarity or relative infrequency of this occurrence. Many authors state that the metastatic lesion was diagnosed only after it had caused pain, swelling, or numbness of the lip and chin for some period of time. Of course, this condition is not seen frequently in daily practice; however, it is not as rare as is indicated in the literature.

One reason more metastatic lesions of the mandible are not detected is that a specific investigation of the mandible is often omitted from the roentgenographic skeletal survey made for the purpose of locating metastases. Metastatic bone lesions usually occur as a late manifestation of the disease and they can only be detected roentgenographically by changes in density of bone. Some of these metastatic lesions are not symptomatic and therefore are overlooked.

One of us had an opportunity to make roentgenograms of the mandibles of ten patients who had a history of carcinoma of the breast, prostate, thyroid, or kidney and who had no oral complaints. All ten patients were in the terminal stages of the disease. Of these ten patients, three showed roentgenographic evidence of metastasis to the mandible. Two of these three with evidence of metastatic carcinoma were asymptomatic and one, after lengthy questioning, admitted having had pain in the mandible but he tended to minimize it in comparison with his pain elsewhere.

Some patients develop oral complaints and are treated with dental remedies or by tooth extraction and sedatives, while the true diagnosis is not established until the disease has been allowed to progress for a long period of time. The following case illustrates the type of delay in diagnosis often encountered.

■ *Report of Case*

A 44 year old housewife presented herself with the chief complaint of pain in the left side of the mandible and face and an inability to open her mouth. She had consulted her dentist approximately six months previously because of soreness in the molar region of the left side of the mandible. He told her that she had a "bad wisdom tooth" and then removed the mandibular first molar tooth because it was loose. After removal of the tooth, she developed pain in the left side of the mandible which became extremely severe.

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Several weeks later she developed a numbness of the lower lip and chin on the left side. Accompanying this was a progressive trismus of the left masseter muscle. There was no history of an elevation of temperature, no acute phase in the process and no suppuration or drainage was noted by the patient. Her only therapy consisted of hydrogen peroxide mouthwashes daily for the past six months which had been prescribed by her local physician.

Her past history brought out the fact that she had had a left radical mastectomy five years previously (1948) for adenocarcinoma of the breast. Two years prior (1951) she had had a hysterectomy for carcinoma of the cervix. Periodic examinations since that time for recurrence of neoplasm were reported as negative.

Her maternal grandmother died of cancer at the age of 57 and her father died of the same disease at the age of 64. She has had no pregnancies.

Examination revealed a slight asymmetry of the left side of her face in the area of the ramus of the mandible. The swelling extended from the zygomatic arch to the angle of the mandible inferiorly and anteriorly to the first bicuspid tooth along the body of the mandible. The swelling was hard and boardlike with no tenderness except over the parotid gland just anterior to the left ear.

Oral examination was limited because of the inability of the patient to open her mouth more than 0.8 cm. No ulceration, hemorrhage, or suppuration was noted, and the mucosa appeared intact.

Roentgenographic examination (Fig. 1) revealed an essentially normal right side of the mandible. The roentgenogram of the left side of the mandible revealed an irregular, diffuse, radiolucent area of bone destruction. There appeared to be a medullary disturbance in the anterior portion of the body of the mandible, while there was a definite loss of cortical bone along the inferior border of the mandible. There were several punched out areas in the cortical plate. The socket of the missing molar tooth did not appear to be healing satisfactorily.

The clinical impression was that the mass was a neoplastic process, possibly of metastatic origin, and a biopsy was performed through an incision in the mucobuccal fold in the region of the first molar tooth.

Microscopic examination revealed that the specimen was composed of clumps of neoplastic cells situated in a dense connective tissue stroma (Fig. 2). These tumor cells were arranged in cords, irregular masses, and occasionally filled lacunarlike spaces of varying size. The cells were large, round, or ovoid, showed a well-defined vesicular nucleus with usually only one nucleolus, and had a delicate eosinophilic cytoplasm. Many of the cells exhibited clumping of the chromatin. There appeared to be no typical arrangement of these cells although, in some areas, an attempt at the formation of glandular alveoli was noted. The histologic features were compatible in all respects with a scirrhous carcinoma of the breast.

The diagnosis was adenocarcinoma, metastatic from the breast.

■ *Discussion*

Geschickter and Copeland[1] estimate that approximately a half of all carcinomas of the breast, prostate, kidney, and lung

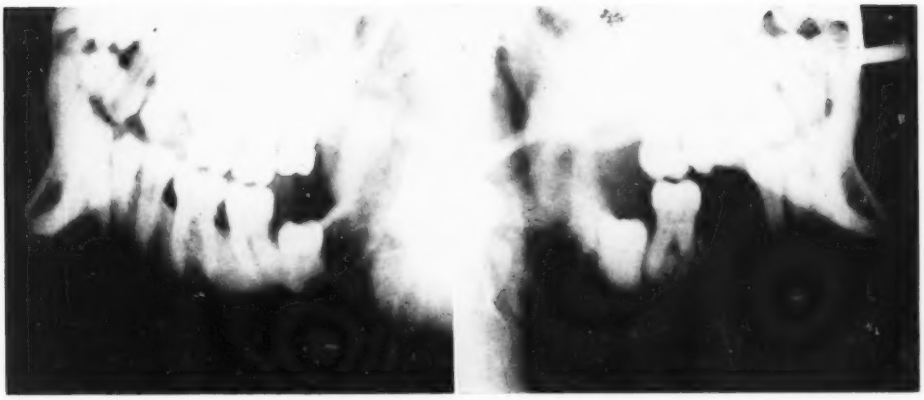

Fig. 1.—Left: Essentially normal appearance of right side of mandible. Right: Left side of mandible, showing irregular, diffuse, radiolucent area of bone destruction, with definite loss of cortical bone along inferior border. Socket of missing molar tooth does not appear to be healing satisfactorily

produce bone lesions before the termination of the disease. This further emphasizes the fact that the condition of mandibular metastasis probably is not as rare as one is led to believe. The condition only appears to be a very rare one because the cases have not been reported.

Gregory[2] reports that in his practice he has made a diagnosis of four metastatic lesions to the mandible in one year. None of these have been reported in the literature. Certainly if he has had this many cases there must be numerous others which also have never been reported.

Metastasis occurs most often to the body of the mandible in the molar areas. This region contains a deposit of hematopoietic tissue, and since the mode of spread is almost always hematogenous, the vascular medullary portion is the most frequent site for bone metastasis. The location then is usually a central one in the body of the mandible. Metastasis is characterized by a marked lacunar resorption with bone destruction thereby producing a decrease in density or radiolucency of the osseous tissue. As the lesion expands, pressure is exerted on the mandibular nerve causing pain which may be followed by or associated with paresthesia or anesthesia of the lip and chin.

The most frequent sites from which carcinomas metastasize to the mandible are the prostate, breast, thyroid, ovary, lung, kidney, rectum, uterus and adrenals. Likewise, when searching for metastatic lesions of bone, for example from the breast, roentgenographic examination should be made of the spine, pelvis, femur and skull as the most common sites in the order named. Bone metastases have common roentgenographic features which allow them to be classified as osteo-

1. Geschickter, C. F., and Copeland, M. M. Tumors of bone, ed. 3. Philadelphia, J. B. Lippincott Co., 1949.
2. Gregory, G. T. Personal communication, July 1953.

blastic (bone-forming)—metastatic prostate tumors being a good example—while the metastatic lesions from the breast usually form osteolytic (bone-destroying) metastases.

Burch,[3] Holland,[4] Frank and Pratt,[5] Kostrubala and others,[6] Waldron,[7] and Kwapis and Kuebel,[8] among others, have presented case reports on different types of metastatic tumors in which they illustrate the classic symptoms of metastatic carcinoma. Probably the first symptom is slight discomfort or pain. This usually is followed by numbness of the lip and chin on the affected side. The teeth in the affected area may become loose and extruded and

3. Burch, R. J. Metastasis of neuroblastoma to the mandible: report of case. J. Oral Surg. 10:160 April 1952.

4. Holland, D. J. Metastatic carcinoma to the mandible. Oral Surg., Oral Med. & Oral Path. 6:567 April 1953.

5. Frank, V. H., and Pratt, C. I., Jr. Lymphosarcoma with metastasis. J. Oral Surg. 9:19 Jan. 1951.

6. Kostrubala, J. G.; Thurston, E. W., and Chapin, M. E. Metastatic dysgerminoma of the mandible. Oral Surg., Oral Med. & Oral Path. 3:1184 Sept. 1950.

7. Waldron, C. A. Metastatic carcinoma of the mandible. Adenocarcinoma of the lung with metastatic lesion of mandible as first clinical sign. Oral Surg., Oral Med. & Oral Path. 5:185 Feb. 1952.

8. Kwapis, B. W., and Kuebel, J. O. Bronchogenic carcinoma with probable metastasis to the gingiva: report of case. J. Oral Surg. 10:255 July 1952.

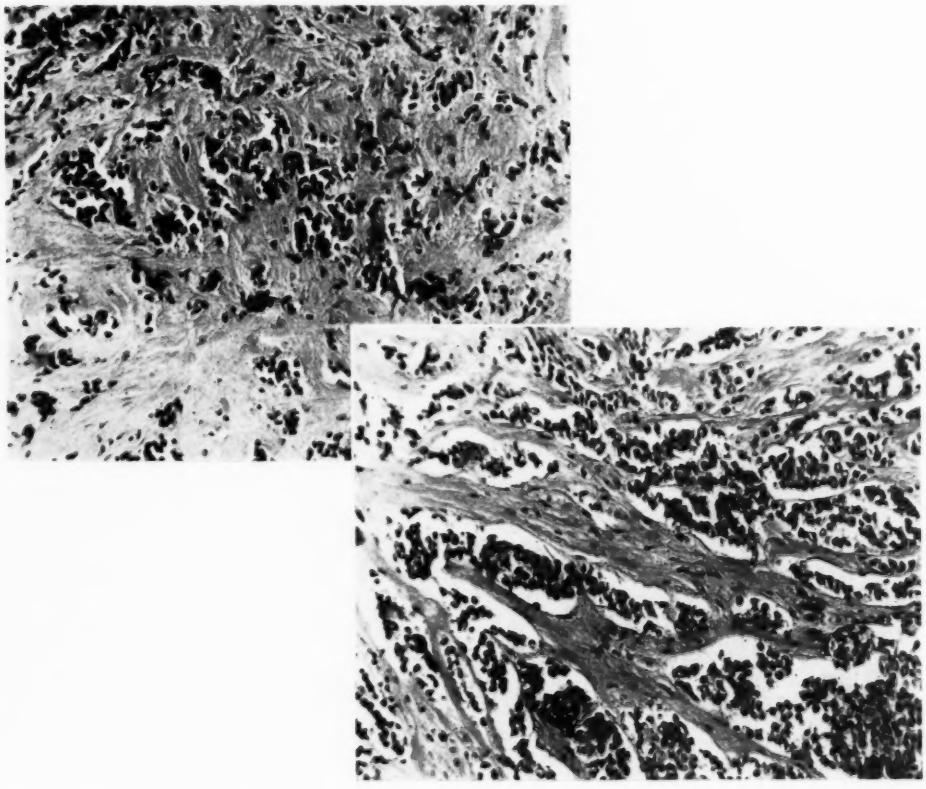

Fig. 2—Microscopic view showing clumps of neoplastic cells situated in dense connective tissue stroma

often are removed without knowledge of underlying carcinoma. Such teeth should be looked on with suspicion and until the entire picture is considered and a diagnosis has been made the teeth should not be removed. A mass or swelling may become evident and, depending on the location, it may involve the muscles and produce trismus. Fracture of the mandible may occur because of the destruction of bone by the expansion of the pathological process. The roentgenographic picture varies from one of a mild medullary disturbance to a gross destruction of the mandible and fracture.

The importance of listening to the patient and letting him tell of his complaints in his own words cannot be overemphasized. After the complaints are related, these should not be considered lightly but every attempt should be made to determine the cause by various diagnostic means.

A good all-inclusive history is of great importance in the diagnosis of metastatic lesions. It should include all acute and chronic illnesses, treatments, hospitalizations and operations. Vague answers such as "female troubles" or "female operations" are not satisfactory, but by persistent questioning a definite description or diagnosis of all previous conditions must be obtained. A family history should also be included in a complete work-up of the patient's history.

A thorough examination of all the oral structures is an absolute necessity if these metastatic lesions are to be recognized. This should be followed by periodic roentgenographic examinations, especially of patients who have a history of carcinoma of the prostate, breast, thyroid, ovary, lung, kidney or rectum.

After all the facts and findings are collected they should be correlated and a tentative diagnosis established. While carcinoma should always be considered in a differential diagnosis, a final diagnosis may be arrived at only after a biopsy of any suspicious areas in the roentgenograms.

If one metastatic lesion is found, there should be a roentgenographic skeletal survey to determine whether other lesions are present before treatment is started. There must be cooperation between the medical and dental fields in such cases. As Martin[9] has so ably expressed it, "The policy of consultation among those who practice the healing arts is an old and accepted custom in difficult cases of all kinds and requires no particular emphasis so far as cancer is concerned."

9. Martin, Hayes. Cooperation between the dental and medical professions in the fight against cancer. J. Oral Surg. 7:342 Oct. 1949.

■ STEADFAST DOUBT

Gladly suspend disbelief: even make-believe may rise to the dignity of a symbol. But put thy trust in steadfast doubt.—*Albert Guerard, "Proverbs of a Humanist," from Bottle in the Sea, 1954.*

Reticulum cell sarcoma of the chin

■ *William F. Harrigan,* M.D., D.D.S.; Frank S. Butler,† M.D., and Arnold B. Schaffer,‡ D.D.S., New York*

Ewing[1] describes lymphosarcoma as "a true malignant neoplasm arising in lymphatic tissues from proliferation of atypical lymphoid cells and occurs as a localized or a diffuse process . . . the tumors arise in a chain of lymph nodes or in a localized lymphatic structure, and rapidly produce bulky growths which obliterate the outlines of the separate nodes, infiltrate surrounding tissues, and tend to result in necrosis and ulceration of skin and mucous membrane. . . ."

Today it is accepted that although the vast bulk of lymphosarcomas (lymphoma) are associated with lymph nodes, the potential of developing a lymphoma is present throughout the entire body. Craver[2] states,

> . . . in general, you can say that any tissue anywhere in the body can be involved by these diseases. There is no tissue, no part of the body, that is entirely immune to being involved by Hodgkin's disease, leukemia or lymphosarcoma. . . .

In a study of 196 cases of lymphosarcoma, Sugarbaker and Craver[3] summarize their results as follows:

> As far as the records in this series show, lymphosarcoma most commonly begins and runs its course only in lymph nodes. Two-thirds of this series of patients never showed evidence of an extranodal primary lesion. In the one-third in whom an extranodal primary lesion was found, it was located in one of the structures of the head and neck in 65%, chiefly in the tonsils and nasopharynx. . . .

Ewing[1] has noted that, "anatomically, there are three elements in lymphoid tissues capable of originating lymphoid tumors; viz., (1) lymphocytes, (2) reticulum cells of follicles and pulp, and (3) endothelial cells of pulp and cavernous sinuses."

Jackson and Parker[4] state:

> Many authors still regard reticulum-cell sarcoma as one variety of lymphosarcoma and use the term lymphosarcoma, reticulum-cell type. However, we believe that reticulum-cell sarcoma is a distinct entity from the point of view of histogenesis, cell type, pathological, and clinical characteristics. The reticulum cell according to our point of view is identical with the histiocyte, clasmatocyte, macrophage, or large wandering mononuclear cells. . . . It occurs not only in lymphoid tissues but in varying numbers in all tissues. . . . The reticulum cell, then, responds to certain bacterial toxins and is also the chief scavenger cell of the tissues, phagocytosing necrotic cells of all types, and attacking foreign bodies of any nature. . . .

If this opinion is actually an accurate interpretation, it is then apparent that

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‡Assistant resident, department of oral surgery, Bellevue Hospital.

1. Ewing, James. Neoplastic diseases: a treatise on tumors, ed. 4. Philadelphia, W. B. Saunders Co., 1940.

2. Craver, Lloyd F. Lymphomas and leukemias and their oral manifestations. New York D. J. 13:237 May 1947.

3. Sugarbaker, E. D., and Craver, L. F. Lymphosarcoma—a study of 196 cases with biopsy. J.A.M.A. 115:17 July 6; 115:112 July 13, 1940.

4. Jackson, Henry, Jr., and Parker, Frederic, Jr. Hodgkin's disease and allied disorders. New York, Oxford University Press, 1947.

reticulum cell sarcoma may arise from any organ or tissue in the body. It would, therefore, be a simple process to explain extranodal reticulum cell sarcomas, and also the fact that they might be located in a region of lesser lymphatic drainage would not be remarkable.

■ *Etiology of Lymphosarcoma: Role of Chronic Inflammation*

Ewing,[1] in discussing the etiology of lymphosarcoma, states:

> Lymphosarcoma, representing a lawless proliferation of reticulum cells and their derivatives, may be attributed, *a priori*, to any irritant which influences these unstable cells over a considerable period or in a specific manner. There is no urgent necessity for assuming the existence of any unknown microorganism or any other occult factors in the origin of this process, for when the above principle is applied in the study of cases a large proportion of lymphosarcomas are reasonably accounted for. . . . Lubarsch assumes that any infectious agent may serve as the exciting cause, and, chiefly because of the close dependence of the process upon microorganisms and their products, he would separate the lymphosarcoma from other or true neoplasms. For the same reason Borst anticipates the ultimate identification of lymphosarcoma with infectious granulomas. . . .

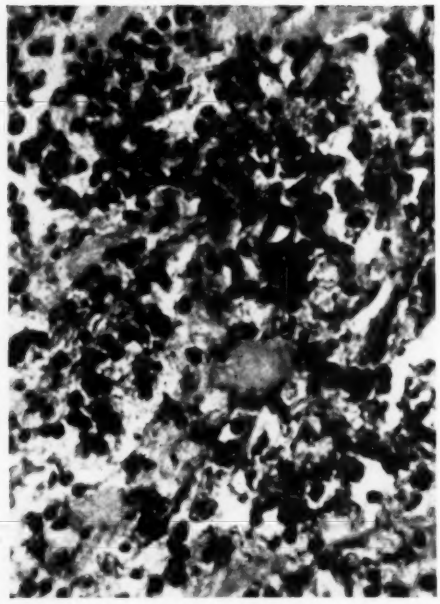
The following case history shows that there was abscess formation two years before the establishment of a diagnosis of a malignancy. There was a constant purulent discharge from the area, osteomyelitis with removal of sequestrae, subsequent pathologic fracture of the mandible, alcohol injections, nerve evulsions and finally a diagnosis of reticulum cell sarcoma. Careful physical examination failed to reveal any other evidence of malignancy, and the conclusion was that this malignant process was limited to the region reported.

■ *Report of Case*

A 70 year old Polish farmer was admitted to Bellevue Hospital in December 1950 with the chief complaint of swelling of the left side of the jaw which had started about two years previously and had constantly increased in size. The patient declared that he had been hospitalized twice previously. His first hospitalization had been in August 1948 at which time his chief complaint was swelling of both sides of the mandible after the extraction of four teeth in April of that year.

The swelling of the left side had occurred first, appearing only a few days after the extractions. At that time, incision and drainage of the left side of the jaw were instituted, and the swelling decreased only to reappear a short time later. Recurrence of the swelling was accompanied by spontaneous intraoral and extraoral drainage. A fixed, nontender mass then appeared overlying the right side of the mandible. Roentgenographic examination revealed evidence of osteomyelitis of the left side of the mandible with sequestration in the mental region. A course of antibiotic therapy, followed by sequestrectomy, resulted in improvement, and the patient was discharged.

He was readmitted one month later with frank evidence of pathological fracture of the left side of the mandible, secondary to osteomyelitis. Antibiotic therapy was resumed and sequestrectomy was again carried out. The fracture was reduced and immobilized first by external pin fixation and, subsequently, by circumferential wiring which was left in place for ten weeks.



Then followed a series of events that were essentially as follows: In March 1949 the patient complained of paresthesia of the lower lip. An injection of alcohol into the mental foramen was accomplished but with little relief of symptoms. In May suppuration was noted from the lower left cuspid and bicuspid region. In June local sequestrectomy was done intraorally and several spicules of bone were removed. Suppuration ceased and good healing occurred. In February 1950 the patient complained of pain in the mental region of the left side of the mandible. An alcoholic

Fig. 1—Photomicrograph of section reveals neoplastic cells to be discrete with small deeply stained nuclei and scant cytoplasm, resembling lymphocytes. Some of the nuclei are larger and paler. These cells are located in a fine meshwork. They invade the deeper portions of the dermis, the fibroadipose tissue and striated muscle. Diagnosis was malignant lymphoma

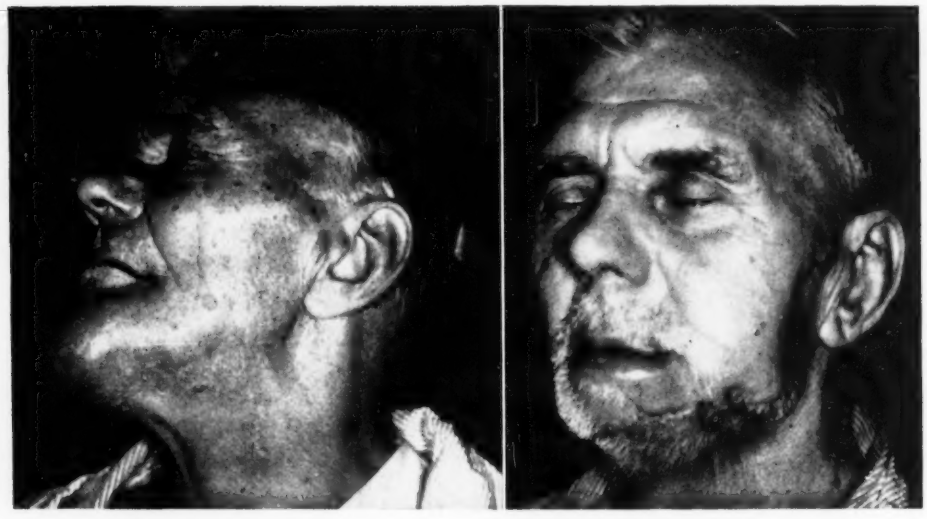


Fig. 2—Left: Preoperative view of patient. Right: Postoperative view of same patient

injection and a prescription for atropine failed to relieve the symptoms. In August a left mental avulsion was performed and a mass of necrotic tissue was removed from the region. The biopsy indicated chronic inflammatory reaction with granulation. The pain disappeared temporarily, only to return. In November a biopsy of tissue in the mucobuccal fold of the left bicuspid region was taken and the subsequent microscopic report was chronic inflammatory reaction with granulation tissue. In December biopsy of a mass that extended extraorally from the left mental region was done. The histopathologic diagnosis was malignant lymphoma (Fig. 1). The patient was hospitalized for complete physical examination and treatment.

PHYSICAL EXAMINATION—On admission, examination revealed a fixed, firm mass, 12.5 cm. in diameter, attached anteriorly to the left side of the mandible. The overlying skin was reddened, hot and tight. A firm lymph node, 1 cm. in diameter, could be palpated on the lingual aspect of the mandible (Fig. 2, left).

Complete physical, roentgenographic and laboratory studies failed to reveal evidence of significant pathology elsewhere in the body.

Since the tumor appeared to be well localized, and there was no definite evidence of metastasis, surgical removal was decided on.

OPERATIVE PROCEDURE—Elliptical incisions which skirted the base of the tumor were made and the skin flaps were dissected free. By sharp dissection, the large tumor mass was freed from the muscles of the lower part of the face and it was removed by stripping the periosteum from the mandible. A 3 cm. fistula into the floor of the mouth was demonstrated. As the dissection proceeded, an area approximately 2 cm. in diameter was discovered just to the left of the midline. It appeared to be a region of irregular periosteal necrosis, about 1 by 1 cm. A large amount of necrotic material was attached. This was curetted and sent for microscopic study. The remainder of the tumor was swept down over the mandible and was included in the tissue which was removed in a bloc dissection of the suprahyoid region of the left side of the neck. The submental nodes also were removed. The wound was closed in the usual fashion. After microscopic study, the specimen was reported as reticulum cell sarcoma.

As of this writing, the patient is alive and shows no evidence of recurrence or metastasis (Fig. 2, right).

■ *Discussion*

A factor that should not be overlooked in this case is that paresthesia of the left side of the lower lip was a chief source of annoyance to the patient for at least seven months prior to the establishment of the diagnosis of malignant lymphoma.

Because of the history of infection and subsequent fracture of the mandible in the region of complaint, too much consideration was given to these factors as nerve irritants, and the possibility of malignancy was not given due consideration.

Craver, Blum and Kaletsky all stress the importance of paresthesia as an initial symptom when lymphomas or metastatic tumors are present.

■ *Summary*

A case of reticulum cell sarcoma developing in the subcutaneous tissues of the chin region is presented in which there was a relatively long history of trauma and infection preceding the diagnosis of lymphoma. No evidence of metastasis could be found. The diagnosis is of unusual interest since the tumor developed in a region of lesser lymphatic drainage with no apparent primary nodal involvement.

Correction of mandibular prognathism by intraoral ostectomy

■ *Raymond F. Huebsch, D.D.S., Philadelphia*

Many operations for the surgical correction of mandibular prognathism by resecting a segment of bone from the body of the mandible have been reported in the literature. Most of these operations involve both intraoral and extraoral procedures and are performed in one or two stages. The patient is left with scars at the extraoral sites on the mandible.

The case of mandibular prognathism herein described (Fig. 1) was corrected using an intraoral approach exclusively. An ostectomy was done on the left body of the mandible and an osteotomy on the right. The inferior alveolar nerve and vessels were preserved in each instance.

■ *Surgical Procedure*

Plaster study models were made from impressions of the teeth and their surrounding structures and were mounted accurately in an articulator. A predetermined segment was removed in the first molar region of the mandibular model to obtain normal occlusion of the teeth. The teeth in this region were removed and a template of sheet copper was cut to correspond to the size of the segment. This metal plate was used later for measurement during the operation.

The operation was performed under intranasal, endotracheal anesthesia. Bilateral inferior alveolar nerve blocks with procaine hydrochloride were given for hemostasis. An incision, 5 cm. long, was

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made along the crest of the alveolar ridge of the mandible on either side, extending from the ascending ramus to the second bicuspid. Where there were teeth, the interseptal papillae were cut. Oblique incisions were made on the lingual and

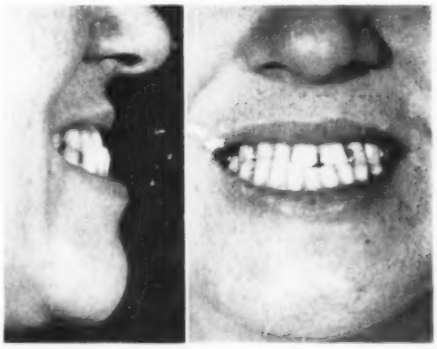

Fig. 1—Preoperative view of mandibular prognathism

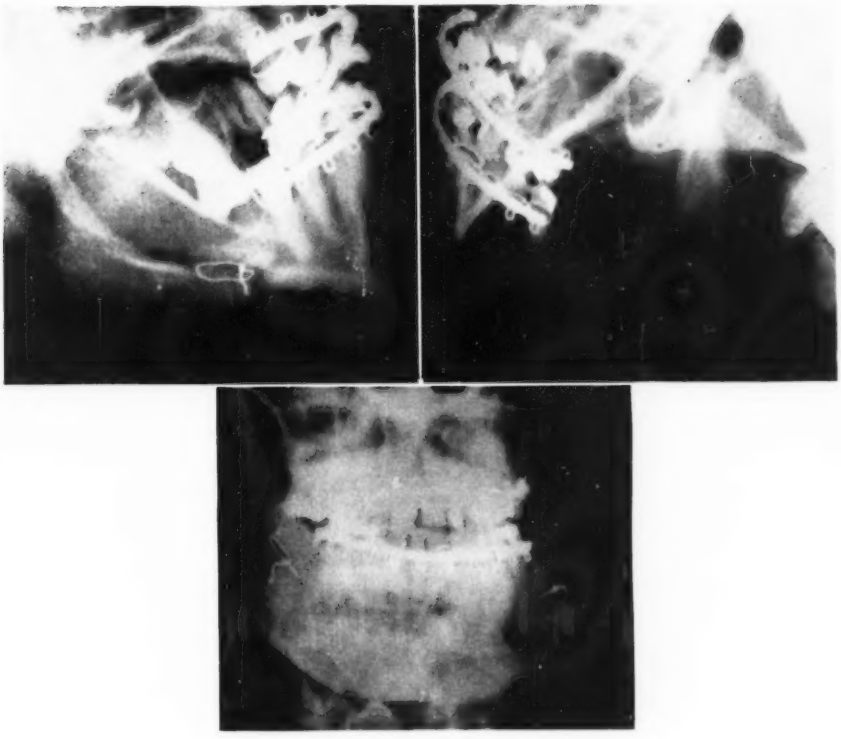

Fig. 2—Postoperative roentgenograms of mandible showing wires in place

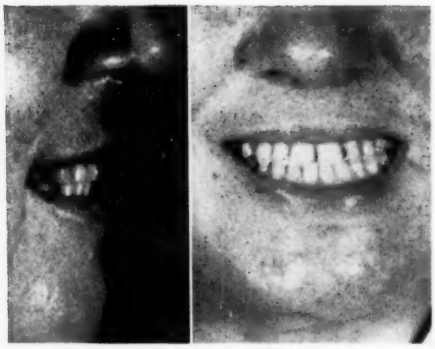

Fig. 3—Postoperative view of patient

buccal surfaces of the mandible in the bicuspid region extending down to the mucobuccal reflection. Care was taken not to cut through the mental structures. The mucoperiosteal flaps were retracted buccally and lingually down to the inferior border of the bone exposing the entire circumference of the body of the mandible. On the left side the metal template was placed on the bone, and the segment of bone to be resected was outlined with an indelible pencil. With a bone cutting bur mounted in a contra-angle handpiece cuts were made on the lines just through the cortical plates on the lingual, buccal, superior and inferior borders of the mandible. The cut segment of cortical bone was removed with chisels and rongeur forceps. The cancellous bone was carefully removed between the cuts, and the inferior alveolar nerve and vessels were exposed. Care was taken not to injure these structures. On the right body of the mandible, a circumferential cut through the bone was all that was necessary in order to free the anterior portion of the mandible and to establish the correction. The teeth were brought into corrected occlusion and the cut fragments were held in position by interosseous wiring. The mucoperiosteal flaps were sutured in their normal position to cover the exposed bone. A pressure dressing was applied to the mandible to prevent soft tissue edema and the formation of a hematoma. The teeth were held in position by intermaxillary elastics until the patient recovered sufficiently from the anesthetic. The following day, the elastics were replaced by wires (Fig. 2). Prophylactic penicillin and a liquid diet were prescribed for the patient. The mandible was immobilized for eight weeks, after which time there was clinical evidence of good fibrous union of the fragments, and the intraoral wires were removed. Paresthesia of the lower lip existed for about three months, then normal sensation returned (Fig. 3).

■ *Summary*

In this case of mandibular prognathism, the surgical correction was performed using an intraoral approach entirely. To accomplish the necessary correction, an ostectomy was done on the left body of the mandible and an osteotomy on the right. The inferior alveolar nerve and vessels were exposed and preserved. Normal occlusion was obtained and there was no external scarring of the face.

Semiburied denture implants: review of literature and experimental study

■ *Frederick C. Nichols, D.D.S., M.S., St. Petersburg, Fla.*

In the past, for a large proportion of patients with artificial dentures, it has been almost impossible to secure adequate retention and stability of the mandibular complete denture for various reasons. In spite of the advances in technic, there are still many patients for whom it is almost impossible to make a satisfactory lower denture.

In the search for a method to provide positive retention of the lower denture, there has recently been a revival of interest in a combined surgical-prosthetic procedure, which at first glance seems to be an ideal solution of the difficulties. The procedure involves the subperiosteal attachment of an inert metal appliance to the bony alveolar ridge. The appliance has several abutments which extend through the alveolar soft tissues into the oral cavity. These metal abutments are utilized in the place of abutment teeth to provide the necessary retention and stability for a complete lower denture. The combination of subperiosteal metal splints and a tooth-bearing denture is known as an "implant denture."

From the standpoint of mechanical design and function these implant dentures have been admirably conceived and well constructed, but they violate a law of nature. In order to perform its proper function, epithelium must remain unbroken; any defect in epithelial continuity constitutes an abnormal situation which the living organism must combat until the defect is eliminated. One of the most vital functions of epithelium is the protection of the underlying tissues. Since this function is dependent on the absolute intactness of epithelium, any surgical procedure involving a permanent break in the continuity of epithelium should be employed only with full knowledge of possible consequences and after careful evaluation.

Thus far, the advocates of semiburied dental and orbital Vitallium implants have appeared to assume either that epithelial continuity within the oral cavity is unnecessary or that the alveolar mucosa is in some way able to seal off the tissue-metal juncture to prevent the passage of bacteria and fluids into the deeper tissues.

All Vitallium implants used in this study were provided by the Berry-Kofron Dental Laboratory Co., St. Louis, and the Austenal Laboratories, Inc., New York.

In view of the lack of information concerning these aspects of semiburied implants, an investigation on experimental animals was carried out to determine the relation which develops between metal and epithelium in the regions where implant abutments pass through alveolar soft tissues into the mouth. In addition, the history of various metals used in surgery, especially for semiburied implants, was reviewed.

■ *Completely Buried Implants*

According to Venable,[1] the first surgeon known to implant metals in living tissues was Petronius, who in 1565 devised a gold plate for use in the repair of cleft palates.

In the next several centuries great controversies arose concerning the merits and disadvantages of metallic implants in general. Levert,[2] Lister,[3] Kittredge[4] and Lane[5] wrote enthusiastically concerning the virtues of various buried metals. In the next few years, however, the practice of implanting metals was condemned vigorously by such men as Hessert,[6] Martin,[7] Albee,[8] Brickner[9] and Magruder.[10] Eventually the metals then in use caused so many serious complications that the implantation procedures were abandoned entirely for many years.

Interest in metal implants was renewed only after the first really scientific investigations were reported by Zierold,[11] Orsós,[12] Jones and Lieberman[13] and others.[14-16] In 1937 the final explanation of the reasons for past failures was provided by the reports of Venable, Stuck and Beach.[17] Their work in the field of electrolysis not only explained previous complications but also led to the development of present-day metals, which are completely inert when buried in living tissues. One of the most important outgrowths of the work done by Venable and his coworkers was the development of the dental alloy Vitallium for use as a completely nonreactive metallic implant.

■ *Semiburied Implants*

EARLY SEMIBURIED DENTAL IMPLANTS—According to Kirk,[18] the first person known to utilize metals as semiburied implants in the human mouth was Maggiolo, who in 1809 inserted a lead-covered platinum root structure to replace a missing tooth. In the next several years,

1. Venable, C. S., and Stuck, W. G. General consideration of metals for buried appliances in surgery. Internat. Abstr. Surg. 76:297 1943; in Surg., Gynec. & Obst. April 1943.

2. Levert, Henry S. Experiments on the use of metallic ligatures, as applied to arteries. Am. J. Med. Science 4:17 May 1829.

3. Lister, Joseph. The treatment of fracture of the patella. Brit. M. J. 2:855 Nov. 3, 1883.

4. Kittredge, T. A case of fracture of the patella, with a new method of wiring. Boston Med. & Surg. J. 125:544 Nov. 19, 1891.

5. Lane, W. A. The operative treatment of simple fractures (with special plate). Brit. M. J. 2:1325 Nov. 18, 1905.

6. Hewert, William. Treatment of fractures of the long bones. Surg., Gynec., & Obst. 13:201, 1911.

7. Martin, Edward. Treatment of ununited fracture. Surg., Gynec., & Obst. 14:252 Sept. 1912.

8. Albee, F. H. The inlay bone graft as a treatment of ununited fractures. Am. J. Surg. 28:21 Jan. 1914.

9. Brickner, W. M. Metal bone plating a factor in nonunion. Am. J. Surg. 28:16 Jan. 1914.

10. Magruder, E. P. The treatment of fractures. Am. J. Surg. 28:1 Jan. 1914.

11. Zierold, A. A. Reaction of bone to various metals. Arch. Surg. 9:355 Sept. 1924.

12. Orsós, E. Bone sutures generating electric currents. Zentralbl. f. Chir. 52:1014 May 9, 1925.

13. Jones, L., and Lieberman, B. A., Jr. Interaction of bone and various metals; vanadium steel and rustless steels. Arch. Surg. 32:990 June 1936.

14. Menegaux, G.; Moyse, P., and Odiette, D. Croissance des tissus conjonctif et osseux cultivés "in vitro" en presence de certains metaux: contribution à l'etude biologique de l'ostéosynthèse. Presse méd. 42:658 April 21, 1934.

15. Menegaux, G., and Odiette, D. Action cytotoxique de certains metaux sur des osteoblastes humains cultivés "in vitro"; contribution à l'etude de l'osteosynthese au point de vue biologique. Presse med. 43:1555 Oct. 5, 1935.

16. Masmonteil, F. De la tolerance de l'os aux corps étrangers metalliques: contribution à l'etude de l'osteosynthese. Presse méd. 43:1915 Nov. 27, 1935.

17. Venable, C. S.; Stuck, W. G., and Beach, A. Effects on bone of presence of metals; based upon electrolysis; experimental study. Ann. Surg. 105:917 June 1937.

18. Kirk, E. C. In Discussion, D. Cosmos 55:439 April 1913.

Edmunds,[19] Harris,[20] Berry,[21] Bonwill[22] and others[23, 24] reported on their variations of the principle of the semiburied implant. The work of Greenfield[25] was published in 1913; it is now of interest chiefly because of the comments made on his work. Inasmuch as the commentators were apparently the first to express doubt concerning the principle of the semiburied implant and not merely concerning the use of metals as implants, their remarks are of interest.

In regard to Greenfield's technic, Guilford[26] stated:

> . . . the gist of the matter, if it is to prove a permanent operation, lies in the ability of the gingival tissue to resist infection.
>
> Undoubtedly an appliance of this kind, inserted in the bone and entirely covered by normal tissue so that it cannot be exposed to infection later, would remain indefinitely; such appliances have been used by surgeons for years. Granting that this operation can be done aseptically, the whole question hinges on the manner in which the gingival tissue is going to act, and how it will heal. Of course there is a cicatrix formed around the cap, and this would afford some protection, as it would hug the cap very tightly, owing to the contraction which always takes place; however, we would not have a normal attachment, as we have between the natural root and the gingival tissue. To my mind the crux of the matter lies in the question whether the gingival tissue will heal in such a way that it will prevent infection.

In the years following the work of Greenfield, the semiburied implant technics fell into disfavor, primarily because the metals then in use corroded and were finally rejected by the tissues. At the same time in general surgery as well, there was dissatisfaction with all metals used for buried implants.

Interest in metals for implantation was renewed about 1936, when Venable, Stuck and Beach[17] demonstrated that the new alloy Vitallium was completely inert in living tissues.

Bodecker[27] offered the first objective criticism of the principle of the semiburial of an implant in denture technics. As did Guilford[26] and Kirk[18] in 1913, Bodecker expressed concern over the impossibility of securing an actual attachment between the implant abutments and the oral epithelium. He declared:

> The purpose of the epithelial attachment is to form a seal around the neck of the tooth which prevents infection from penetrating into the underlying dermis. There is no evidence that gingival tissue can form an impervious seal against metal. It would appear, therefore, that bacteria can penetrate along a metal implant and cause infection in the dermis and bone.

Bodecker questioned also whether the lack of the cushioning effect of a periodontal membrane between metal and bone would not tend to cause pressure necrosis of underlying bone.

Later in 1949, Strock and Strock,[28] apparently intending to refute Bodecker's contentions, reported the results of their

19. Edmunds, J. M. In Clinic report. D. Cosmos 31:371 May; 31:550 July; 31:944 Dec. 1889.

20. Harris, S. M. An artificial tooth—crown on a leaden root. In Hints and queries. D. Cosmos. 29:801 Dec. 1887.

21. Berry, A. Lead roots on teeth for implanting. Ohio J. D. Science 8:549 Dec. 1888.

22. Bonwill, W. G. A. Implanting a tube made of iridium. Pacific Coast Dentist 3:186, 1895.

23. Payne, R. E. Silver capsule implantation. Internat. D. Cong., (Third) Tr. Clinic 4:458, 1900.

24. Fruth, Otto J. A practical case of replantation with porcelain restoration of crown and part of root. D. Cosmos 47:1316 Oct. 1905.

25. Greenfield, E. J. Implantation of artificial crown and bridge abutments. D. Cosmos 55:364 April 1913.

26. Guilford, Dudley. In Discussion. D. Cosmos. 55:437 April 1913.

27. Bodecker, C. F. Replantation, transplantation and implantation. Editorial. New York D. J. 15:240 April 1949.

28. Strock, Moses S., and Strock, Alvin E. Further studies on the implantation of inert metals for tooth replacement. Alpha Omegan 43:107 Sept. 1949.

work with a single semiburied Vitallium implant. After making serial histologic sections of the tissues surrounding the screw implant, they reported:

> A fine layer of connective tissue develops between the implant and its surrounding bone, a so-called pseudoperidental membrane. . . . There is no downgrowth of the gingival epithelium as in periodontal pocket formation.

This was undoubtedly the result in the case they reported, but they were hardly justified in concluding, on the basis of a single specimen, that "Failure of implantation due to epithelial downgrowth is also not a factor."

SEMIBURIED ORBITAL IMPLANTS—The design of some orbital implants is based on exactly the same principle of semiburied implants as the denture implants.

Doherty[29] and Ruedemann[30] were among the first to advocate, in 1941, the use of Vitallium, tantalum and acrylic resin in the form of semiburied implants for replacement of enucleated eyes.

By 1949, the fact that the semiburied implant might be a factor in causing postoperative complications began to be recognized in the opthalmological literature. In that year Ellis[31] wrote: "The status of implants that are not completely covered with conjunctiva has not been fully settled. A number, even under the most favorable condition, are not retained."

In his 1950 review of the entire literature concerning orbital implants, Guyton[32] maintained that the principle of a semiburied implant had a natural precedent in the teeth themselves; and he even credited Ruedemann with being, in 1941, the first in the entire field of surgery to make use of the principle of the semiburied implant. Apparently unaware of the dental literature on semiburied implants, which dates back at least to 1887, Guyton commented:

> The possibility of a non-viable structure with direct attachment to living, subepithelial tissue remaining permanently partially buried and partially exposed, with a consequent line of transition between epithelium and subepithelial tissue in the lining of the structure, is a natural occurrence in the case of teeth; nevertheless, Ruedemann's application of this principle to prostheses was completely original not only in the field of ophthalmology, but in surgery as a whole.

In summarizing the results obtained by various ophthalmologists using semiburied implants, Guyton quotes Stone as saying in an unpublished discussion:

> . . . the theoretical disadvantage of the procedure (semi-buried implants) is great. It controverts basic surgical dictum that a wound must be completely epithelized in order not to break down. Not only is the wound seemingly not epithelized, but there has also been introduced a foreign body which is not epithelized. When an analogous procedure has been attempted in the past by dental or orthopedic surgeons, no matter how small their unepithelized pin might be, sloughing invariably has ensued.

In a later journal, Guyton[33] discussed his development of an orbital "exoplant," which had no subepithelial buried portion, depending instead on epithelium-covered

29. Doherty, W. B. Orbital implants, with special reference to vitallium. Arch. Ophth. 25:637 April 1941.

30. Ruedemann, A. D. Plastic eye implant. Tr. Am. Ophth. Soc. 43:304, 1945.

31. Ellis, O. H. A new orbital implant. Am. J. Ophth. 32:990 July 1949.

32. Guyton, J. S. Enucleation and allied procedures; survey of semiburied implants. Am. J. Ophth. 32:1725 Dec. 1949.

33. Guyton, J. S. Enucleation and allied procedures; new procedure involving use of "exoplant." Am. J. Ophth. 33: 283 Feb. 1950.

rectus muscles passing through tunnels in the prosthesis for retention. He stated, very revealingly, that the application of this new principle

> . . . seemed logical because we had histologic evidence that epithelium grew around and lined the smooth posterior portions of the original Ruedemann and Cutler implants. It seemed likely epithelium would also grow around the muscles where they passed through smooth tunnels (in the prosthesis), provided the raw surfaces of the muscles were not pressed too tightly against the tunnels while epithelization was taking place, and such proved to be the case. The term "exoplant" has been coined to denote that there is contact only with epithelized surfaces (once healing is complete) in contrast to the situation with semiburied implants.

In a composite report on studies of the results obtained with the use of semiburied implants and "exoplants" by four large ophthalmic clinics in the years 1946-50, Drucker and others[34] gave statistics which indicated that during those years approximately 25 per cent of the implants of all types failed completely for various reasons and had to be removed. In addition, an undetermined number of other implants resulted in the development of less serious, delayed complications, which, though undesirable, did not necessitate the removal of the implants—at least, up to that time.

RECENT SEMIBURIED IMPLANT DENTURES—After the development of the electrolytically inert alloy called Vitallium, the first major advance in the design of semiburied implants used in dentistry was made by Goldberg and Gershkoff.[35] Insofar as implants for the stabilization of a denture were concerned, their work, first reported in 1949, was based on an entirely new concept, involving a single appliance which supported four retention-providing abutments. The subperiosteal framework was held in place by four screws during the healing process. When it was inserted later, the redesigned denture or "superstructure" was supported entirely by the four intraoral abutments. On the basis of a 13 month follow-up of their first case and study of subsequent cases, Goldberg and Gershkoff concluded that the lower implant denture provided all the desirable attributes of an ideal lower denture.

Berman[36] in 1951 presented his technic, which involved a four-abutment implant designed without the usual intraosseous screws to provide temporary stabilization for the implant itself. Berman maintained not only that screws were unnecessary but that they were a definite source of trouble because lateral forces applied to the implant during mastication caused them to loosen and eventually to exfoliate.

In a 1952 discussion of the development of the modern implant denture, Sullivan[37] objectively evaluated all aspects of the technic. He offered several suggestions concerning the technical phases of implant construction and commented thus on the principle of the semiburied implant:

> The biggest danger appears to be the possibility of seepage around the abutments and its eventual harm. We all admit that implants have

34. Drucker, A. P., and others. Integrated and buried implants. Am. J. Ophth. 34:1483 Nov. 1951.

35. Goldberg, N. I., and Gershkoff, Aaron. The implant lower denture. D. Digest 55:490 Nov. 1949.

36. Berman, Nicholas. An implant technique for full lower denture. D. Digest 57:438 Oct. 1951.

37. Sullivan, Edward J. Discussion: fundamentals of the implant denture. J. Pros. Den. 2:49 Jan. 1952.

been used fairly successfully by orthopedic surgeons for some time, but their implants have no direct connection with the outside and are completely covered. The authors (Goldberg and Gershkoff) are apparently content to rely on clinical observation alone. . . . Since the histologic information is entirely lacking, we have no idea how long these cases will remain in the mouth.

■ *Epithelial Attachment*

The basic nature and significance of the attachment of oral epithelium to the human tooth should be considered in detail. There is one group of workers who consider teeth as naturally occurring, semiburied implants, contending therefore that there is no reason why semiburied metals should be contraindicated. There is also another group of workers who apparently feel that the lack of union between epithelium and implanted metal has no bearing on the prognosis of their technic.

A brief review of what is considered to be the most acceptable concept of the normal relation between oral epithelium and inorganic tooth structure may be helpful in clarifying this problem.

During the formation of enamel rods, the ameloblasts lay down the organic interprismatic substance also. Orban[38] states that when enamel formation has been completed, the ameloblasts produce a thin membrane on the surface of the enamel—the primary enamel cuticle. This is a partially calcified organic limiting membrane, about one micron thick, which is continuous with the organic interprismatic substance, elements of which, in turn, extend through the entire thickness of the enamel.

After the formation of this primary enamel cuticle, the ameloblasts merge with the stratum intermedium and the outer enamel epithelium to form a stratified epithelial covering for the enamel—the reduced enamel epithelium. As the tooth erupts, the reduced enamel epithelium over the tip of the crown fuses with the oral epithelium. In the center of this region of fusion the cells degenerate to permit the crown to emerge into the oral cavity.

Before the reduced enamel epithelium merges with the oral epithelium, however, it produces the secondary enamel cuticle. This is a homogeneous keratinized, brittle structure, which fuses with the primary enamel cuticle beneath it.

When the tip of the enamel crown first emerges through the degenerating region of oral epithelium, the reduced enamel epithelium is in the form of a wide band around the crown, extending from the point of its junction with oral epithelium to the cementoenamel junction. As the tooth erupts, the outer cells of the reduced enamel epithelium continue to elaborate the layer of secondary enamel cuticle.

Since the reduced enamel epithelium merges imperceptibly into oral epithelium, the secondary enamel cuticle thus becomes continuous with the keratinized layer of stratified squamous oral epithelium. As the secondary enamel cuticle is formed, the reduced enamel epithelium separates itself from the enamel surface, gradually exposing the erupting crown. As eruption continues, the band of attached epithelium becomes narrower,

38. Orban, Balint. Oral histology and embryology. St. Louis, C. V. Mosby Co., 1944, p. 218-228.

while the gingival sulcus becomes deeper and approaches the cementoenamel junction.

By the time this point in development has been reached, the following conditions apparently exist: (1) the inorganic enamel rods are surrounded throughout their length by organic interprismatic substances; (2) the organic tubes surrounding enamel rods merge on the outer enamel surface to form the primary enamel cuticle; (3) primary enamel cuticle and secondary enamel cuticle are continuous with the keratinized outer layer of oral epithelium. Thus there is a definite, unbroken organic attachment between the tooth and the epithelium, through which bacteria cannot pass unless the attachment is broken (Fig. 1).

Evidence to support this concept of organic union between enamel and epithelium has been presented by various investigators. Gottlieb[39] was the first to advance the concept that epithelium is actually united organically with enamel; the importance of the fact that the juncture is more than a simple physical approximation, however, is not as yet generally realized.

Orban and Mueller[40] presented histological evidence to demonstrate the truth of Gottlieb's new concept. In regard to the attachment of the epithelium to the enamel, they stated: "No bacteria or food or anything else can go through this epithelium, because it is united with enamel. There is no space between the enamel and the epithelium. An instrument can be passed freely between the enamel and epithelium only to the bottom of the crevice."

Becks,[41] Toller,[42,43] Skillen[44] and Kronfeld[45] have presented additional histological evidence in support of the concept of organic union between enamel and epithelium.

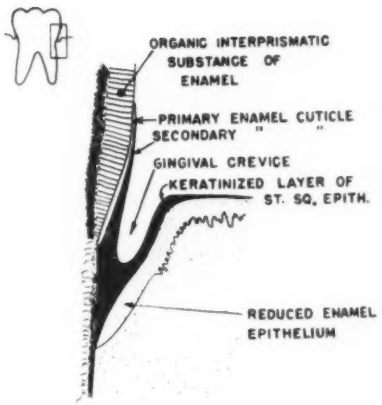

Fig. 1—Diagram illustrating mechanism of epithelial attachment provided by continuity of organic substance uniting enamel or cementum of normal tooth and adjacent oral epithelium. All organic components of tooth and attached epithelium are interconnected, chemically united. There is no interruption or separation between inorganic tooth and organic epithelium; each organic structure merges imperceptibly with adjacent organic structures

Bodecker and Applebaum[46] also have demonstrated the union of enamel and epithelium, presenting histologic sections showing that in order to break the attach-

39. Gottlieb, Bernhard. Tissue changes in pyorrhea. J.A.D.A. 14:2178 Dec. 1927.

40. Orban, Balint, and Mueller, Emil. The gingival crevice. J.A.D.A. 16:1206 July 1929.

41. Becks, Hermann. Normal and pathologic pocket formation. J.A.D.A. 16:2167 Dec. 1929.

42. Toller, J. R. Studies of the epithelial attachment in young dogs. Northwest. Univ. Bul. 40:13 Jan. 1, 1940.

43. Toller, J. R. The organic continuity of the dentine, enamel and epithelial attachment in dogs. Brit. D. J. 67:443 Nov. 1, 1939.

44. Skillen, William G. The morphology of the gingivae of the rat molar. J.A.D.A. 17:645 April 1930.

45. Kronfeld, Rudolf. The epithelial attachment and so-called Nasmyth's membrane. J.A.D.A. 17:1889 Oct. 1930.

46. Bodecker, Charles F., and Applebaum, Edmund. The clinical importance of the gingival crevice. D. Cosmos 76:1127 Nov. 1934.

ment of epithelium, the enamel cuticle must be split and that this separation may require more force than the separation of connective tissue from overlying epithelium.

In the absence of evidence to show that subepithelial tissues can protect themselves adequately from infection when they are not covered by intact epithelium, it becomes necessary to determine what changes take place in the tissues surrounding implant abutments as these tissues attempt to accommodate themselves to the new situation.

■ *Experimental Technic*

In order to secure specimens for histological examination of tissues surrounding implant denture abutments, four mature dogs were selected as experimental animals. A few deviations from the usual design of denture implants used in human beings were necessary to make the procedure feasible in dogs. The design changes and reasons for them were as follows:

1. In order for the animal to retain enough teeth for adequate mastication during a long-term project, the teeth were removed from only one lower quadrant of each dog's mouth.

2. It was decided that a one-quadrant implant would be sufficiently large to parallel conditions under which a lower implant denture functions in the human being, since the remaining teeth in the dog would help protect the implant from excessive trauma by maintaining proper vertical dimensions.

3. There were no denture "superstructures" constructed for use with the dog implants because they could have no direct influence on the reactions of the tissues around the implant abutments, provided that those tissues were adequately protected from direct trauma. To provide such protection, an intraoral cap or platform was cast as part of each abutment.

4. In order to allow the edentulous region to develop an adequate cortical layer of bone, approximately 16 weeks was allowed to elapse between the extraction of the teeth and the insertion of the implants.

5. In making the first Vitallium implant, the Goldberg-Gershkoff method of intraoral guide-casting and roentgenograms were used to obtain a model of the bony alveolar ridge. Since the method was not sufficiently accurate to provide a well-adapted casting, however, the procedure was discarded in favor of a preliminary direct impression of the mandible. The first implant, made by using the roentgenographic template technic, was so unsatisfactory that it will not be included in this report.

6. The first five implants made for the dogs had screws to provide temporary retention for the appliance, but in every case the alveolar mucosa failed to heal over the screws. In the fifth case, the screws were purposely removed soon after they were found to be exposed. Their removal seemed to slow down the progress of soft tissue retraction, though it never ceased entirely.

7. In the sixth case, the implant framework was redesigned to allow the substitution of circumferential wiring for retention screws, as advocated by Ber-

man[47] for use in implant dentures for human beings. The framework of the sixth implant was designed so that there was no metal bar resting on the crest of the alveolar bony ridge, as there was in previous implants.

8. For two of the implants, in which the overlying alveolar mucosa retracted until almost half the entire framework was exposed, a double-end pedicle flap was moved up from the buccal tissues in an attempt to increase the amount of tissue locally available to cover the metal.

In making denture implants for the dogs, the general procedure in each case was as follows: With pentobarbital sodium (1 cc. of a 6½ per cent solution per 5 pounds of body weight) administered intravenously as an anesthetic, four teeth were extracted from the lower left quadrant. Alveolotomies were performed in any regions indicated, and the tissues were sutured with monofilament nylon. Approximately 12 weeks after the teeth were extracted, the soft tissues were reflected from the alveolar ridge and kept retracted with stay sutures while an alginate impression of the bone was taken. The framework and screw positions were outlined on stone models, which were sent to the laboratory for processing of the implants. Castings were inserted in the dogs' mouths 16 weeks after the removal of the teeth.

After the insertion of an appliance, each dog was placed on a soft diet, which required no chewing and which was fortified with additional vitamins and minerals. The nontraumatic consistency of the diet was maintained throughout the experiment. When indicated, some of the dogs were given 400,000 units of depot penicillin daily.

After varying periods of time ranging from two to five months, the implants and surrounding tissues were removed en bloc. Several methods were used in preparing the tissues for examination. In two cases, half an implant with its adjacent tissues was quick-frozen in a stabilized liquid medium composed of 95 per cent alcohol and dry ice, which attains a temperature of -78° C.

The specimens were ground slowly until half an abutment and adjacent tissues were ground away (Fig. 2), with the frozen state maintained during the grinding by frequent reimmersion of the specimen in the alcohol-dry ice solution. The ground surface of the tissues was then stained by the routine hematoxylin-eosin procedure, and low-power photomicrographs were taken of the specimen. The implant framework was then cut beyond the plane of the ground surface, the metal lifted out of its tissue bed, and the specimen run through the routine procedure for histologic serial sections.

Other segments of tissue and implant were fixed immediately in 10 per cent Formalin and later cut in various planes so that the metal could easily be lifted out of its position in the investing tissues. The specimens of interest were then run through the routine procedure for sectioning.

■ *Discussion of Results*

The progress of the third, fourth and fifth implants differed from that of the first two implants only in that there was more nearly complete initial healing of

47. Berman, Nicholas. Unpublished report presented before American Academy of Implant Dentures. St. Louis, September 1952.

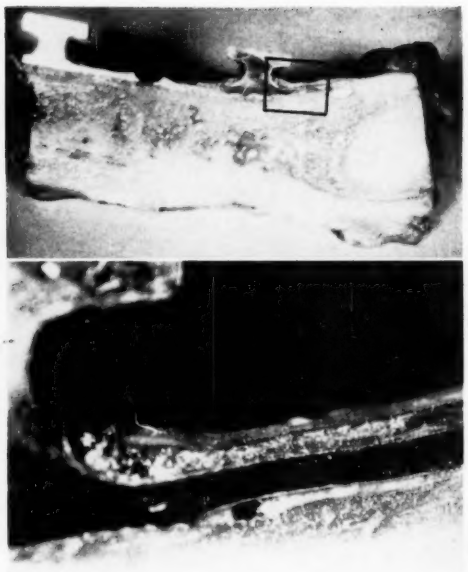

Fig. 2—Above: Type of specimen obtained by quick-freezing and grinding tissues with implant in situ. Below: Enlargement of outlined area, showing ground surface of implant and surrounding soft tissues

Fig. 3—Above: Low-power photomicrograph of one end of specimen shown in Figure 2, after removal of implant and sectioning of tissues. Note layer of fibrous connective tissue between bone, with which metal had previously been in direct contact, and position occupied by implant. Below: Higher magnification of outlined area. Epithelium has grown down between metal and connective tissue originally in contact with metal, having reached point labelled "E"

alveolar mucosa over the retention screws in the later cases. Even so, some weeks after the insertion of the implants the tissues began to break down in various isolated regions so that the implant framework was exposed. Once the metal was exposed, tissue retraction was slow but inexorable, just as the tissue retraction described by writers who have used orbital implants. After loose screws were removed, several attempts were made to resuture the tissues over the implant as the sites of new exposure developed, but to no avail. Once it began, the retraction process continued.

The sixth implant was the most successful as far as clinical appearance was concerned. The use of circumferential

wiring seemed to offer advantages over screw retention, since the wires did not loosen and have to be removed and since the absence of a metal bar on the alveolar crest apparently allowed the incision to heal more rapidly and completely.

In experiments with dogs, it appears that there is not a tight mechanical seal between metal and tissue, much less any union which could prevent the passage of bacteria. The use of a gentle stream of air directed with a bulb syringe down along an abutment demonstrated the absence of a tight seal, provided that the presence of a cap of metal did not interfere with proper placement of the air jet.

Some workers using Vitallium implants have commented on the fact that when for some reason an implant has to be removed there seems to be a rather tenacious gripping of the metal by surrounding soft tissues. In the present study, although there was close approximation between the metal and the tissue, no difficulty was experienced in slipping pieces of Vitallium gently out of their tissue beds in either the live or the dead animal. There was, of course, resistance if a whole meshwork had to be lifted out as a unit, but single small sections were observed to be merely lying free in a smooth-lined pocket of tissue.

In confirmation of the observations of other workers, it was noted that in every case the implants which had originally been placed directly on the bone surface, at the time of removal were resting on a layer of dense fibrous connective tissue (Fig. 3-5). This layer was apparently a protective measure provided by

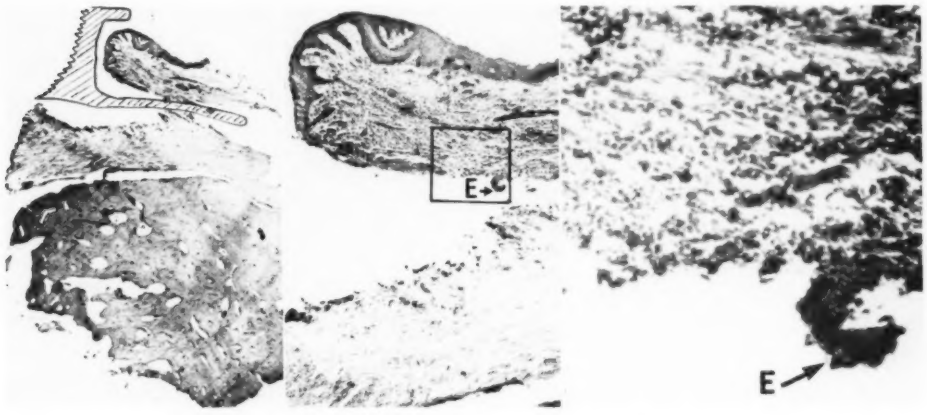

Fig. 4—Left: Low power magnification of tissues sectioned after removal of implant from position indicated by ink sketch. Most superior segment of specimen was attached to lower portion beyond plane of sectioning. Note thick layer of connective tissue which developed between bone and metal. Center: Medium-power magnification of portion of specimen shown on left; E, end point of epithelial downgrowth. Note massive number of inflammatory cells, infiltrating tissues which were above and below supporting bar of implant, and inflammatory process, extending considerable distance from abutment area. Right: High-power magnification of tissues outlined in center, showing extent of process of epithelial downgrowth

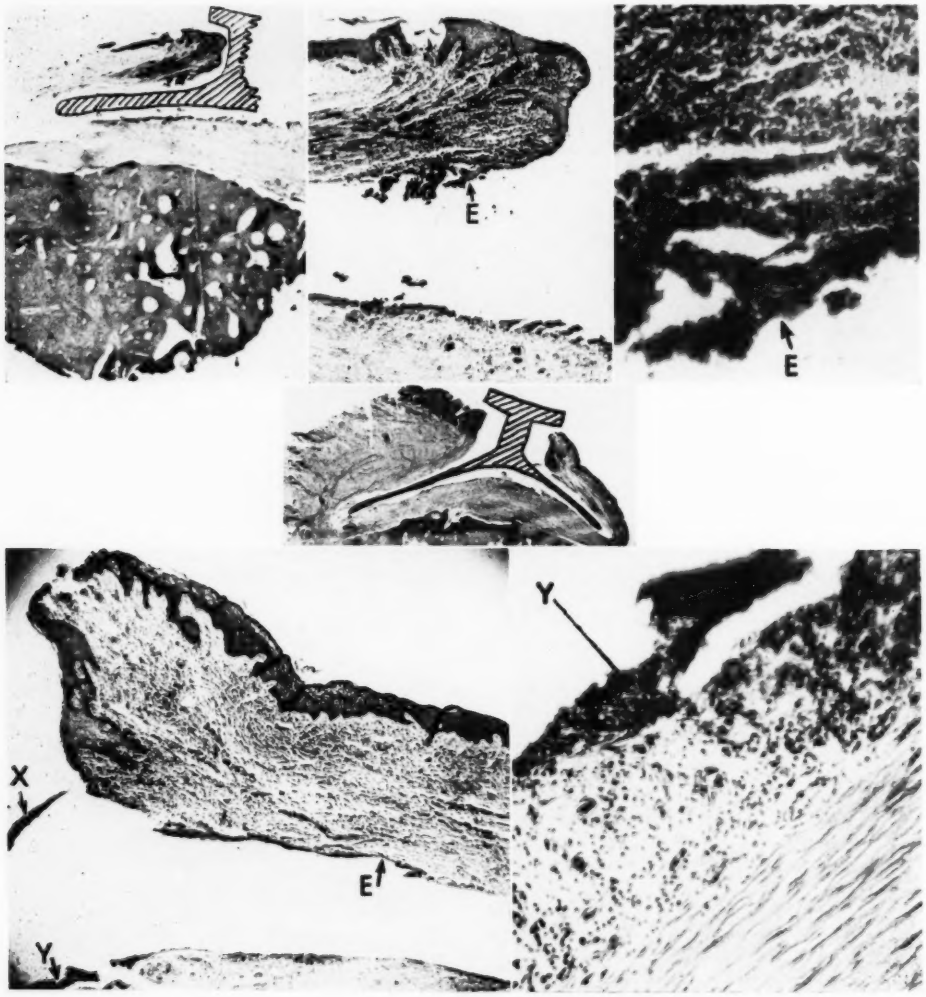

Fig. 5—Above left: Low-power view of specimen similar to that shown in Figure 4. Note again thick layer of fibrous connective tissue between bone and metal. Above center: Medium-power view of abutment region. Note extent of epithelial downgrowth at E and inflammatory process, involving soft tissues which surrounded metal implant. Above right: High-power view of tissues, showing extent of downward migration of epithelium at E. Center: Low-power view of specimen cut and ground in buccolingual direction. Position of implant is indicated by sketch. Usual layer of fibrous tissue between bone and implant is well illustrated in this specimen. Below left: Medium-power magnification of tissues which surrounded right (buccal) side of implant; E, extent of epithelial downgrowth; segment of layer of epithelium pulled away from underlying connective tissues. At Y epithelium has grown far enough to surround supporting bar of Vitallium and is beneath inferior surface of implant. Below right: Higher magnification of portion of epithelial layer at Y

the tissues for the supporting bone, corresponding to the "pseudo-peridental membrane" described by Strock and Strock.[28] This layer of connective tissue was, of course, continuous with that which invested the entire framework, except where there were regions of intervening epithelium.

The histologic sections shown in Figure 3-5 demonstrate that in the case of semiburied implants in dogs' mouths, oral epithelium slowly insinuates itself between the metal and underlying connective tissue. Eventually the implant would no longer be semiburied but instead would be completely exfoliated and merely resting in an epithelium-lined pocket.

These photomicrographs show also that the free edge of epithelium does not remain at the position it occupied when the implant was inserted but that it grows down along the buried surface of the metal for a varying distance. The letters on the figures indicate the location of selected specimens; the tissues of these specimens were sectioned at various levels and in different planes. The original position of the implant is indicated on the low-power photomicrograph of each specimen. The tissues were obtained two, four and five months after insertion of the implants. The final photomicrograph in each case shows that epithelial downgrowth is a continuing process. Just how far along the space between metal and tissue the epithelium would grow eventually is unknown, but there seems to be no reason why it should not continue indefinitely, provided that a severe infection or some other factor did not interfere.

The greatest amount of inflammation involving the epithelial and connective tissues surrounding the implants is observed in the soft tissues closest to the implant abutments, with a gradual decrease in degree of reaction with increased distance from the site of the breaks in the epithelium (Fig. 6, above and center).

The process of epithelial downgrowth which inevitably follows the placement of a semiburied metal implant is represented in the diagrams of the lower part of Figure 6. Diagram A represents the conditions which exist immediately after implantation when the layer of epithelium is open and at right angles to the protruding abutment. Diagram B shows conditions a few weeks after the insertion of the implant when the epithelium has begun to grow down along the abutment, insinuating itself between the metal and the subepithelial connective tissues. In addition to the process illustrated, there is also a certain amount of replacement of bone by connective tissue immediately beneath the implant. By the time the epithelium has grown down to the point indicated in diagram B, there is also some migration of inflammatory cells into the tissues.

Diagram C illustrates the conditions observed in the specimens used in the experiment several months after the insertion of the semiburied implants. The process of epithelial downgrowth has continued, and the epithelium has migrated back along the supporting bar of the implant framework. The implant is no longer in direct contact with bone, and the soft tissues in the region of the abutment are massively infiltrated by inflammatory cells.

All the factors involved seem to indicate an attempt on the part of the host

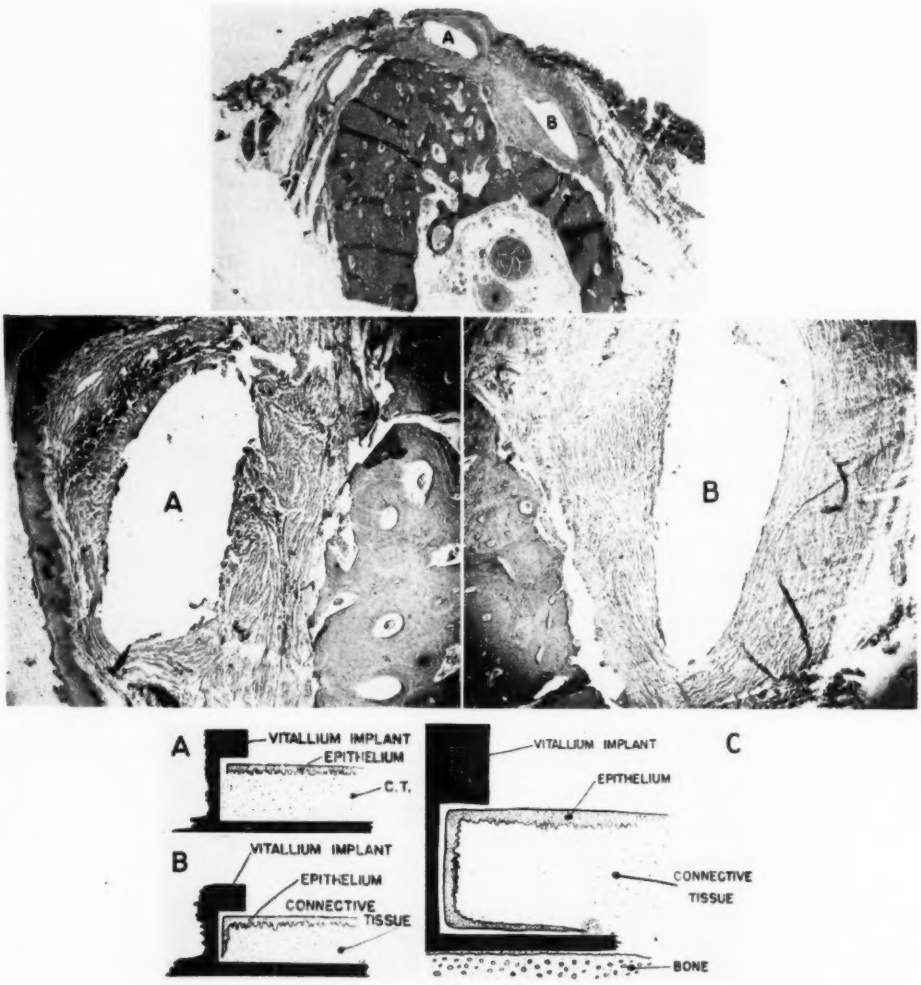

Fig. 6—Above: Low-power view of specimen obtained by cutting cross section through buccal, occlusal and lingual supporting bars of implant and also through region almost at distal end of implant, as far from abutment region as possible. Space A, occupied by occlusal bar, was much closer to abutment than buccal bar space, B. Center left and right: Higher magnification of A and B. Note large amount of inflammatory cell infiltration of tissues around space A, compared with relatively healthy tissues around buccal bar space, B. Below: Diagrams of process of epithelial downgrowth after placement of semi-buried metal implant. Diagram A shows process immediately after implantation, diagram B a few weeks later. Diagram C shows process as observed several months after implantation. Implant is no longer in direct contact with bone, and soft tissues adjacent to abutment are massively infiltrated by inflammatory cells

tissues to reject the implant as a foreign body, not because any irritation is caused by the metal itself, but rather because the presence of the abutments creates an abnormal break in the continuity of protecting epithelium.

■ *Summary*

In the past various metals have been used as semiburied implants in living human tissues. Certain inert metals are used also in modern surgery, particularly for semiburied orbital prostheses and implant dentures.

These prostheses violate the physiological principle of epithelial continuity. The physiologic reactions of oral epithelium and connective tissues to the presence of implant denture abutments are significant.

Six Vitallium implants, with a design appropriately modified from that originated by Goldberg and Gershkoff for use in human patients, were inserted in the oral tissues of four dogs. The length of time during which the implants were in function varied from two to five months. None of the implants remained successful clinically longer than four and a half months, despite various changes in design which were made in an attempt to achieve better results. In the course of the experiment the following clinical and histological observations were made:

1. The metallic alloy Vitallium caused no discernible inflammatory reaction when it was buried deep enough in oral tissues to avoid direct infection.

2. A gentle stream of air directed toward the collar of soft tissues surrounding the implant denture abutments showed that there was not a tight approximation between the metal and the oral mucosa.

3. Epithelial cells tended to migrate down between implant abutments and surrounding connective tissues, with no apparent evidence of attachment between the epithelium and the metal.

4. The extent of migration of epithelial cells between metal and connective tissues appeared to depend on the length of time that the individual appliance had been implanted, although small differences in extent were noted in various sections of the same implant.

5. There was massive inflammatory infiltration of epithelial and connective tissues in regions adjacent to implant abutments. The amount of inflammatory involvement decreased with increased distance from the abutment regions.

6. Metallic implants originally placed in contact with bone did not remain in contact indefinitely; rather, a layer of connective tissues was gradually interposed between bone and metal. The occurrence of osteoclasis on the surface of the bone closest to the metal indicated active bone resorption beneath the implants.

■ *Conclusion*

The results of this study do not support the current practice of utilizing the semiburied implant in artificial dentures and permanent prostheses in man. In fact, the principle of the semiburied implant appears untenable. It may be wise, therefore, to re-evaluate the present-day implant denture technic and the indications for its use.

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The fascial spaces of the floor of the mouth

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The present work was undertaken in order to ascertain the fascial spaces in the floor of the mouth and their communications, if any, with the spaces in the neck. Specifically, the study was undertaken in an attempt to find out in what direction and along what fascial planes purulent material in the floor of the mouth is likely to travel.

■ *Investigation by Dissection*

Preliminary investigations were carried out by ordinary dissection. The floor of the mouth lies within a strong bony arch – the mandible – open posteriorly. Within this, but at a slightly lower and more posterior level, lies another but smaller bony arch–the hyoid bone. The mylohyoid muscle arising from the inner aspect of the mandible slopes downward and inward to be inserted into the antero-lateral portion of the hyoid bone and into a median raphe extending from the hyoid bone to the mandible.

The two mylohyoid muscles taken together, therefore, form a gutter or channel sloping downward and posteriorly. The superior constrictor muscle, which forms the wall of the upper part of the pharynx, arises from the pterygomandibular raphe and extends downward to the posterior end of the origin of mylohyoid muscle on the mandible. The origin of the middle constrictor muscle extends to the insertion of the mylohyoid muscle on the hyoid bone (Fig. 1). The mouth and pharynx as a whole may be likened to a gutter formed by the two mylohyoid muscles sloping back into a vertical pipe–the pharynx–and can be called the buccopharyngeal tube. At the elbow, or junction of the gutter with the pipe, there is a gap in the wall on either side. This gap is bounded above by the lower border of the superior constrictor muscle, below by the upper border of the middle constrictor muscle and in front by the posterior border of the mylohyoid muscle. For convenience it may be called the buccopharyngeal gap.

The floor of the gutter and the anterior part of its curve into the pharynx are occupied by the tongue anteriorly and the epiglottis posteriorly. All structures entering or leaving the tongue–lingual nerve, lingual artery, glossopharyngeal nerve and hypoglossal nerve–pass in through the buccopharyngeal gap. So like-

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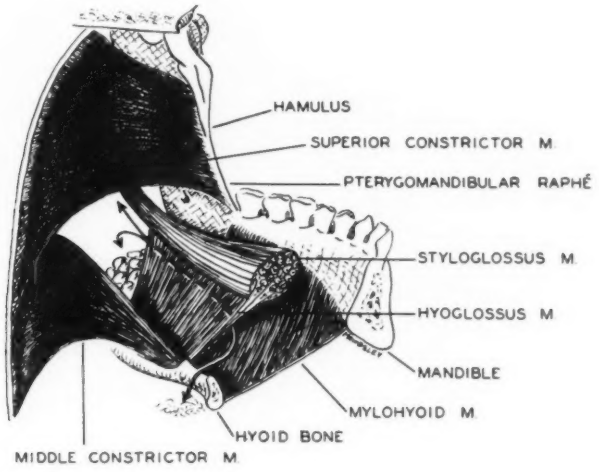


Fig. 1—Buccopharyngeal junction viewed from inside showing buccopharyngeal gap. Note that both styloglossus and hyoglossus muscles arise outside buccopharyngeal tube and pass in through the gap; hence the suboral space passes posteriorly out of tube. Arrow indicates routes along which pus in suboral space can travel

wise do two of the extrinsic muscles of the tongue itself, the styloglossus and the hyoglossus muscles.

Between the tongue and the inner aspect of the mandible, the floor of the mouth overlies an intermuscular space, here called the suboral space. The suboral space is a three-sided pyramid whose apex is directed anteriorly and base posteriorly. It has a medial, a superior and an inferolateral wall. The medial wall in its anterior third is composed of the genioglossus and geniohyoid muscles and its posterior two-thirds of the styloglossus and hyoglossus muscles. Its upper wall is formed by the mucous membrane of the mouth floor, its inferolateral wall by the mylohyoid muscle. The space contains the sublingual salivary gland, the deep portion of the submaxillary salivary gland, the lingual and the hypoglossal nerves.

Since the two muscles that form the medial wall of the posterior two-thirds of the space—the styloglossus and hyoglossus muscles—both arise outside the buccopharyngeal tube and pass through the buccopharyngeal gap, it follows that the space itself as well as its contents, when traced backward, pass out of the buccopharyngeal tube into the digastric triangle of the neck.

The hyoglossus muscle separates the suboral space from another lying medial to it between the hyoglossus and genioglossus muscles. This space, which is here called the sublingual space, contains the second stage of the lingual artery, and at both the anterior and posterior edges of

the hyoglossus muscle is continuous with the suboral space.

In the floor or keel of the gutter lies the geniohyoid muscle. A fascial space separates it from the raphe of the two mylohyoid muscles below, and a similar fascial space separates it from the genioglossus muscle above. These geniohyoid spaces provide communication between the suboral and sublingual spaces of one side and the corresponding spaces of the opposite side. They also provide passages leading posteriorly and inferiorly to the hyoid bone and thence to the pad of connective tissue and fat between the hyoid bone and the epiglottis at the aditus of the larynx (Fig. 1).

■ *Investigation by Injection of Plaster of Paris*

Further investigations were carried out by injecting either plaster of paris or rubber latex into the suboral space through the floor of the mouth and, by subsequent dissection, discovering in which direction the injected material traveled. It is, of course, obvious that the results of such investigations in the cadaver cannot be carried over without reservations to the living subject. Connective tissue in the cadaver differs in many ways from living connective tissue; it is more fixed, rigid and inelastic. In the living subject, moreover, temperature, posture, the almost continual movement of muscles, and vascular changes or pulsation influence the direction and extent of spread of a fluid material in intercellular spaces. Nevertheless, such researches are valuable in that they reveal the purely physical factors that control the spread of a fluid in either a dead or living subject, although in a living subject other important factors are at work. The results are shown in the table.

In the first four cases, plaster of paris was used and in all four the injected material passed posteriorly and, having traversed the buccopharyngeal gap, poured into the digastric triangle pushing the submaxillary gland downward and anteriorly. In three cases the injected material also traveled through the gap and along the styloglossus muscle, finally reaching the parapharyngeal space. In only one case did the injected material extend into the gaps above and below the geniohyoid muscle and thus transgress the midline and also reach the epiglottis.

In the last eight cases rubber latex was used. In six of these the latex reached

Results obtained in cadavers injected with plaster of paris and rubber latex

	Plaster of paris				Rubber latex							
Case no.	1	2	3	4	5	6	7	8	9	10	11	12
Amt. of injected material (cc.'s)	30	25	50	40	8	6	6	12	25	25	25	30
Spaces reached by injected material												
Traversed buccopharyngeal gap into digastric triangle	x p	x	x	x p		x p		x	x p		x	
Traversed buccopharyngeal gap into digastric triangle and reached parapharyngeal space by traveling along styloglossus muscle		x	x	x			x		x		x	
Traversed geniohyoid space, transgressed midline and reached epiglottis	x				x	x	x			x	x	x

p. In these cases some of the injected material perforated the mylohyoid muscle.

the geniohyoid muscle, traversed the midline and reached the epiglottis. In four cases the material traversed the buccopharyngeal gap into the digastric triangle and in three of these it reached the parapharyngeal space. The greater tendency of the plaster of paris to spread backward probably is caused by the position of the subject and its greater specific gravity.

■ *Observations*

The results indicate that a fluid mass in the suboral space has available two different avenues of spread. It may extend inferiorly into the space surrounding the genioglossus muscle, thence through it to the opposite side burrowing down to the epiglottis and aditus of the larynx. It may also extend posteriorly through the buccopharyngeal gap into the digastric triangle or along the styloglossus muscle into the parapharyngeal space.

Several other points of interest were noted. There was no tendency on the part of the injected material to pass backward into the pharynx or over to the other side along the plane of the submucous tissue. This apparently is because of the palatoglossus muscle which blocks this route posteriorly, for the mucous membrane is fairly firmly attached over the anterior fauces. The mucous membrane is likewise firm over the frenulum of the tongue, blocking egress to the other side. Consequently, the avenue of extension backward into the parapharyngeal space is along the styloglossus muscle.

Figure 2 depicts this muscle as it curves under the lower border of the superior constrictor muscle and thus makes a channel from the suboral space to the parapharyngeal space which lies medial to the styloid process. In Specimen 6 only did any of the injected material pass backward between the internal pterygoid muscle and the ramus of the mandible. This confirms the statement of Coller and Yglesias[1] that the muscles of mastication are all enclosed in a common fascial sheath and therefore lie in a common "masticator" fascial compartment. In Specimens 1, 4, 6 and 9 some of the injected material perforated the mylohyoid muscle, thus demonstrating that this muscle does not form a strong or impenetrable barrier.

The parapharyngeal space lies medial to the styloid process. It is bound posterolaterally by the carotid sheath, and immediately lateral to the sheath, by the fascia that covers the muscles arising from the styloid process. Lateral to the styloid process, the parotid gland with its strong capsule plugs exits in a lateral direction and fills the gap between the styloid process and the masticator fascial compartment. The parapharyngeal space extends medially to the carotid sheath, between it and the side of the pharynx, as far back as Grodinsky's alar fascia which is attached to the posterior aspect of the pharynx and to the carotid sheath itself. Superiorly the parapharyngeal space is bounded by the base of the skull; inferiorly it seems to be limited by the stylopharyngeus muscle at the point where it passes through the posterior end of the buccopharyngeal gap to gain insertion into the posterior margin of the ala of the thyroid cartilage. Briefly the space is enclosed in every direction except along the styloglossus muscle which affords a ready passage between it and

1. Coller, F. A., and Yglesias, L. Infections of the lip and face. Surg., Gyn. and Obst. 60:277 Feb. (no. 2A) 1935.

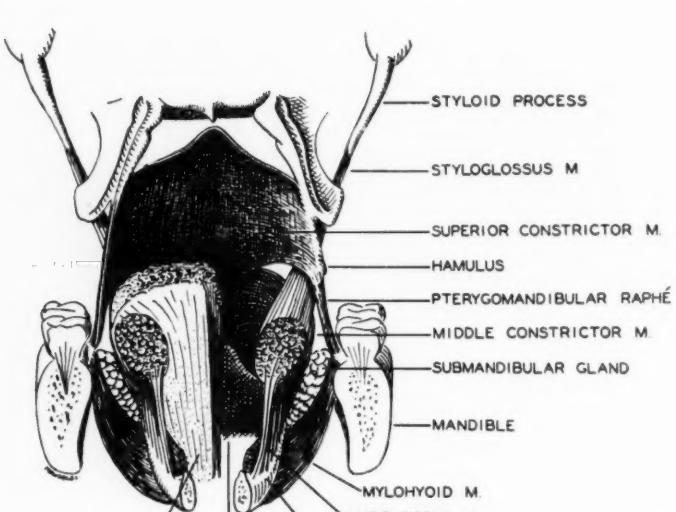


Fig. 2—Styloglossus muscle curves forward under lower free border of superior constrictor muscle of pharynx, thus providing channel from the suboral space to parapharyngeal space

the suboral space. Abscesses in the space may spread by rupturing into the carotid sheath or by breaking through the alar fascia of Grodinsky into the prevertebral space.

In all of our dissections we found the alar fascia exactly as described by Grodinsky and Holyoke,[2] and Grodinsky.[3] We also noted that, as stated by Tschiassny,[4] the roots of the second and third molars extend well below the mylohyoid line of the mandible; the roots of the first molar just reach this line and the roots of all other teeth are above the line. Since according to Trout[5] dental infections are the primary site of infections in about 82 per cent of abscesses in the floor of the mouth and the neck, and according to Schamberg[6] they rarely occur in edentulous mouths, it follows that the rupture of a root abscess in any tooth anterior to the second molar will involve the suboral space (the space between the mylohyoid and hyoglossus muscles), while a ruptured root abscess of the second or third molar will rupture into the digastric triangle below the mylohyoid muscle. This is made

2. Grodinsky, M., and Holyoke, E. A. Fasciae and fascial spaces of the head, neck and adjacent regions. Am. J. Anat. 63:367 Nov. 1938.

3. Grodinsky, M. Ludwig's angina, retropharyngeal abscess and other abscesses of head and neck. J.A.M.A. 114:18 Jan. 6, 1940.

4. Tschiassny, K. Ludwig's angina; anatomic study of role of lower molar teeth in its pathogenesis. Arch. Otolaryng. 38: 485 Nov. 1943.

5. Trout, H. H. Ludwig's angina. Arch. Surg. 41:532 Aug. 1940.

6. Schamberg, M. I. Treatment of suppurative affections of the face and neck emanating from the mouth. D. Digest 12:29 Jan. 1906.

more evident by the fact that although the plate of bone separating the tooth sockets from the outside of the mandible is considerable thicker than the plate separating them from the inside, the latter in the case of the second and third molars is strikingly thinner below the mylohyoid line than it is above (Fig. 3). We gained the impression that the periosteum also is much thicker above than below the mylohyoid line, although it is difficult to measure the difference exactly. If true, however, it may help to explain the more localized nature of abscesses above the mylohyoid line.

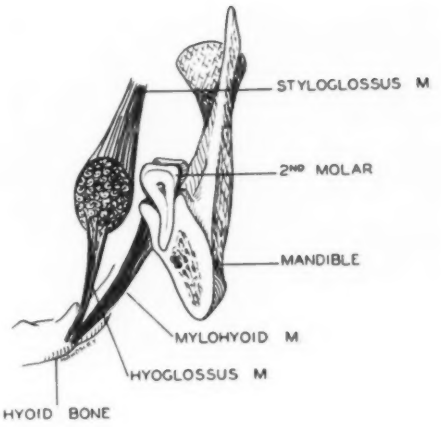


Fig. 3—Coronal section through mandible opposite second molar. Note thin plate of bone separating root of molar from digastric triangle

■ *Summary*

The boundaries and relationships of the suboral, sublingual, and geniohyoid spaces are defined and it is pointed out that the styloglossus muscle affords a ready channel from the suboral space into the parapharyngeal space through the buccopharyngeal gap.

The fascial spaces surrounding the geniohyoid muscle afford another outlet from the suboral space that leads posteriorly to the epiglottis and aditus of the larynx.

The buccopharyngeal gap also affords an outlet into the digastric triangle.

■ Shortcomings of Specialization

Those engaged in arts and science, most Gracious Emperor Charles, find many obstacles to the exact study and successful application of them. In the first place, no slight inconvenience from too great separation between branches of study which serves for the perfection of one Art. But much worse is the mischievous distribution among different practitioners of the practical application of the art. This has been carried so far that those who have set before themselves the attainment of an art embrace one part of it to the neglect of the rest, although they are intimately bound up with it and can by no means be separated from it.—*Vesalius (1542).*

Tube feeding in oral surgery

■ *Fred A. Henny, D.D.S., and James Barron, M.D., Detroit*

The importance of adequate nutrition during the postoperative period is generally known. The oral route is, of course, the natural one for the ingestion of food. Unfortunately, this route frequently is interfered with by the presence of a pathologic condition in the oral cavity—either the preoperative presence of a painful oral neoplasm, traumatic injury of the mouth and jaws, or a wound resulting from the excision of such lesions or the repair of traumatic injuries. Lack of an adequate dietary intake then becomes a source of major concern. The problem must be overcome if the patient's physical state is to be brought up to an optimal level prior to surgery. It likewise is of great importance if wound healing is to progress normally.

In the past, much emphasis has been placed on the use of intravenous alimentation. This method has not been too practical, however, because of low caloric intake, the prohibitive cost, and the frequent lack of good accessible veins. This has served to emphasize the great importance of the more natural oral route. Since small caliber plastic tubes (2.5 mm. or less) have become available, it is possible to bypass any pathologic condition that may be present in the oral cavity by inserting the tube into the stomach through the nose.[1,2] Insertion may be accomplished even in instances where the patient is unable to cooperate in swallowing (Fig. 1). Such a tube then may be maintained in place for a long period of time without fear of local inflammation or ulceration of the mucosa along its course.

In usual cases, a length of plastic tubing is passed through the nose of the patient and down into the stomach in the same manner as is used in passing a regular stomach tube of larger diameter. Ordinarily, a simple request to the patient to relax and swallow will suffice and allow easy and rapid insertion. When the patient is unable to cooperate in swallowing, a small mercury-weighted rubber balloon attached with plain catgut to the end of the tube will facilitate the insertion. The weighted balloon, which is well lubricated, aids in pulling the tube down the esophagus and into the stomach. Dissolution of the gut then allows the mercury-filled bag, which has been tied securely with silk, to pass on through the intestinal tract. To prevent distention of the balloon with gases, several tiny needle perforations should be made in the balloon in order to allow free interchange of gases if necessary. Tube feeding cannot be employed when there is an intestinal obstruction or

From the departments of oral and general surgery, Henry Ford Hospital.

1. Fallis, L. S., and Barron, James. Gastric and jejunal alimentation with fine polyethylene tubes. Arch. Surg. 65:373 Sept. 1952.

2. Barron, James. Tube feeding with liquefied natural foods. Henry Ford Hosp. M. Bull. 2:13 June 1953.

where peristalsis is absent because of some organic pathologic condition.

For some years, we have used prepared liquid feeding formulas of various types in an attempt to find a simple mixture that would be well tolerated and one which also would provide adequate nutritional balance. We have not been completely satisfied with the formulas, however, especially for those patients who had to be kept on tube feeding over long periods of time. When prepared feeding formulas were used, clinical results seldom equaled and never surpassed those achieved when the patient was on a well-balanced diet of natural whole foods. Therefore we decided to use liquefied whole foods—such foods as meat, vegetables, fruit, eggs and milk.

Any of the standard mechanical blenders (Waring, Oster, Universal, and so on) will liquefy the food satisfactorily after all bones and seeds have been removed. It is wise to avoid overloading the machine and to add sufficient liquid in the form of fruit juice, homogenized milk or soup to provide a good vortex. Adequate liquefaction usually will be obtained after 5 to 10 minutes of mechanical blending. The liquefied material is then removed and strained through a fine-wire gauze strainer to remove particles that might otherwise tend to obstruct the tube. Since straining may remove some proteins, one or two eggs should be added to each food tray to insure more than adequate replacement of the protein.

If only one or two patients are under treatment at any one time, a mechanical blender is adequate. In a large hospital, however, where the number of patients frequently is large, it is preferable to use a colloid (serum) mill[3] that will liquefy much larger quantities of food and make the particles themselves smaller. Usually the food mill is placed in the central kitchen where a diet can be prepared in the desired quantity for each patient.

Fig. 1—Polyethylene tube in place. Connecting needle may require occasional changing because of blockage. The tubing usually is taped in such a fashion that it is out of the patient's way when not in use

A mechanical pump has been developed by one of us (J.B.) (Fig. 2) which has given excellent results in passing liquefied food through small caliber tubes at a desired constant rate. In general, it is desirable to use a slow-speed pump when the patient is first started on such a diet, since rapid ingestion may cause gastric distress or even nausea and vomiting. The slow pump will pass one liter of food into the stomach within 7 to 9 hours. For those patients who must be fed over a

3. Manufactured by Admiral Tool & Die Co., Long Island City, N. Y.

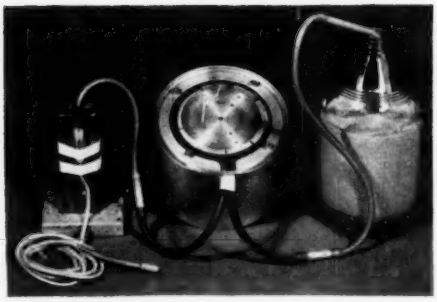


Fig. 2—Electric pump (center) operates on a displacement principle with consecutive compression of the tubing by nylon plungers. Liquefied food (right) is pumped through tubing which is connected to the polyethylene tube by a 15 gauge, 1⅝ inch needle

considerable period of time, a faster pump is desirable after the initial four or five days. Such a pump will deliver a liter of liquefied food into the stomach within 1 to 2 hours. The amount of calories in a daily diet can be varied as desired. Through the use of such a pump, it is possible for a postoperative oral surgery patient who is otherwise completely unable to take food by mouth to gain weight while under such treatment.

In the past, patients who have undergone major oral surgery have gone through a prolonged period of healing. A state of subnormal nutrition resulting from inadequate food intake has been almost inevitable. The lack of adequate nutrition, combined with the tension and abrasion produced on intraoral suture lines if there is any attempt at mouth feeding, certainly is not conducive to good, prompt wound healing. Under such circumstances, the use of tube feeding of liquefied whole food has been gratifying for it has resulted in a shorter convalescent period and better healing; also, it has usually resulted in a moderate weight increase. This, in turn, adds up to generally improved operative results with more comfort for the patient and fewer undesirable postoperative sequelae.

■ National Educational Level

The educational attainments of the American people are advancing steadily, according to information made available by the 1950 Census of Population. Even though the number of people at ages 25 and over increased by about 12,800,000 between 1940 and 1950, the number without formal schooling declined from 2,800,000 to somewhat less than 2,185,000, or by 22 per cent. On the other hand, the number of men and women with at least four years of college to their credit increased to 5,285,000, or by 55 per cent. A good single measure of the educational progress in the decade is the median number of years of school completed, which advanced from 8.6 to 9.3 among adults aged 25 or older.—*Statistical Bulletin 34:9 March 1953.*

Fractures of the hyoid bone

■ *Louis H. Guernsey, D.D.S., Fort Douglas, Utah*

Fractures of the hyoid bone are extremely rare; their rate of occurrence is only 0.002 per cent of all fractures.[1] Prior to the middle of the nineteenth century, the literature contained little reference to such fractures.[2]

Because of the anatomic structure, it is unlikely that a fracture would involve only the hyoid bone; rather the fracture of this bone is usually associated with fractures of the mandible or of the thyroid and cricoid cartilages. When a fracture of the hyoid bone does occur, therefore, it may happen that the patient is treated for the associated fractures of the facial bone while the fracture of the hyoid bone is not recognized by the oral surgeon.

■ *Anatomic Considerations*

The hyoid, a V-shaped bone (Fig. 1), is situated in the anterior part of the neck between the symphysis of the mandible and the larynx. It consists of the body of the bone and two pairs of processes, the greater and the lesser cornua.

The body of the hyoid bone is arranged transversely across the midline of the neck. On the anterior surface, there are four depressions for muscle attachments. The posterior surface is concave and separated from the epiglottis by the hyothyroid membrane and loose areolar tissue. The membrane passes upward from the thyroid cartilages and is attached to the superior border of the hyoid bone. Interposed between it and the bone is a synovial bursa.[3]

Nelson[4] reports 31 cases of hyoid bursitis, a distinct clinical entity, with symptoms referable to the throat; he observes that this condition is four times more prevalent in men than in women.

When the larynx is pulled up during swallowing, the posterior surface of the bone overlaps the thyroid cartilages of the larynx, and the bursa lessens the friction between them.[4] This bursa is variable in size, sometimes being as large as a thumb. Its action is analogous to that of an object moving in contrary motion in space; through this type of motion, a surface of cleavage is created and maintained in the loose areolar tissue.[5]

In man, the hyoid is the only bone which normally forms no joint with other bones. It is often referred to as the "tongue bone." It has considerable range of upward, downward, backward and forward mobility.[6] This flexibility of the hyoid bone and surrounding structures gives it unusual protection; this protection is prob-

Captain, post dental surgeon, Fort Douglas, Utah.

1. Slack, H. R., Jr. Fractures of the hyoid bone. In Textbook of surgery, ed. 3, Christopher, Frederick, editor. Philadelphia, W. B. Saunders Co., 1942, p. 617.

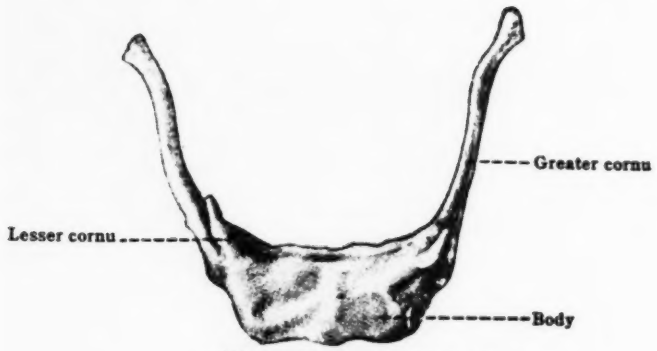
2. Stimson, L. A. Fractures and dislocations, ed. 6. Philadelphia, Lea & Febiger, 1910, p. 180.

3. Schaeffer, J. P., editor. Morris' Human anatomy, ed. 11 Philadelphia, Blakiston Co., 1953, p. 169.

4. Nelson, L. A. Hyoid bursitis. Texas State J. Med. 36:435 Oct. 1940.

5. Batson, O. V. Personal communication.

6. Klinefelter, E. W. The anomalous hyoid; review of the literature and report of a case. Radiology 58:224 Feb. 1952.



—HYOID BONE. (*Ventral view.*)

Fig. 1—The hyoid bone. (From Morris' Human Anatomy. Courtesy of Blakiston Co.)

ably one reason why fractures of the hyoid bone are rare.[7]

The greater cornua project upward and backward from the sides of the body of the bone. They are flattened from above downward and terminate posteriorly in a rounded tubercle to which the thyrohyoid ligament is attached. The lesser cornua are small conical processes projecting upward and backward opposite the lines of junction between the body of the bone and the greater cornua; their apexes provide attachment to the stylohyoid ligaments. In the adult, the lesser cornua are sometimes partly or completely cartilaginous.[8]

The muscles attached to the hyoid bone are of two classes: the suprahyoid muscles and the infrahyoid muscles.

The suprahyoid muscles are arranged between the skull and the hyoid bone. They function to elevate the hyoid bone and the larynx or to depress the mandible. Their action depends on the state of contraction of other muscles. If the mandible is immobilized by the action of the masseter, temporal and internal pterygoid muscles, the suprahyoid muscles will depress the mandible. The suprahyoid muscles are the digastric, the stylohyoid, the mylohyoid and the geniohyoid muscles (Fig. 2).

The infrahyoid muscles (Fig. 3) are arranged between the hyoid bone above and the sternum, the clavicle and the scapula below. These muscles form two layers: (1) the superficial one consisting of the sternohyoid and omohyoid muscles, which unite the sternum and the shoulder girdle to the hyoid bone; (2) the deeper layer, connecting the sternum to the thyroid cartilage and in turn to the hyoid muscle by means of the sternothyroid and the thyrohyoid muscles.

The infrahyoid muscles have a double function: to depress the hyoid bone and with it the larynx or to immobilize the hyoid bone, as if it were fixed to the chest.

7. Slack, H. R., Jr. Fractures of the hyoid bone. In Textbook of surgery, ed. 3, Christopher, Frederick, editor. Philadelphia, W. B. Saunders Co., 1942, p. 618.

8. Schaeffer, J. P., editor. Morris' Human anatomy, ed. 11. Philadelphia, Blakiston Co., 1953, p. 170.

This immobilization of the hyoid bone allows the suprahyoid muscles to depress the mandible.[9]

■ *Etiology*

The most common cause of hyoid bone fractures is direct trauma, for example, trauma incurred in an automobile accident when the chin and the neck are thrust violently against the dashboard or the steering wheel. Strangulation in a suicidal attempt or in a felonious assault may account for a few cases, and muscular action during deglutition likewise causes an occasional fracture of this bone.[10]

A pathologic fracture of this bone can occur in case of tumor of the hyoid bone. Winslow in 1907 reported on six such cases, in which the tumor varied from an endochondroma to a sarcoma.[11]

Manipulation was assumed to have caused a fracture of the hyoid bone in one case reported by Forbes.[12]

■ *Symptoms*

The symptoms of a fracture of the hyoid bone may be either subjective or objective.

SUBJECTIVE SYMPTOMS—When a fracture of the hyoid bone occurs, the patient feels a distinct snap or a sensation in the upper part of the neck that a solid body is giving way; this sensation is followed by severe pain, by difficulty in swallowing, breathing and speaking and in some cases by complete aphonia.[11] If the fragments extend into the pharynx, there will be bleeding from the mouth. Coughing also is a rather frequent symptom.

9. Sicher, Harry. Oral anatomy, ed. 2. St. Louis, C. V. Mosby Co., 1952, p. 138-143.

10. Speed, K. A textbook of fractures and dislocations, ed. 4. Philadelphia, Lea & Febiger, 1942, p. 326.

11. Winslow, R. Injuries and diseases of the hyoid bone. Ann. Surg. Philadelphia 45:575, 1907.

12. Forbes, S. B. Fracture of the greater cornu of the hyoid bone—perforation of pharynx; case report. J. Florida M. A. 17:585 June 1931.

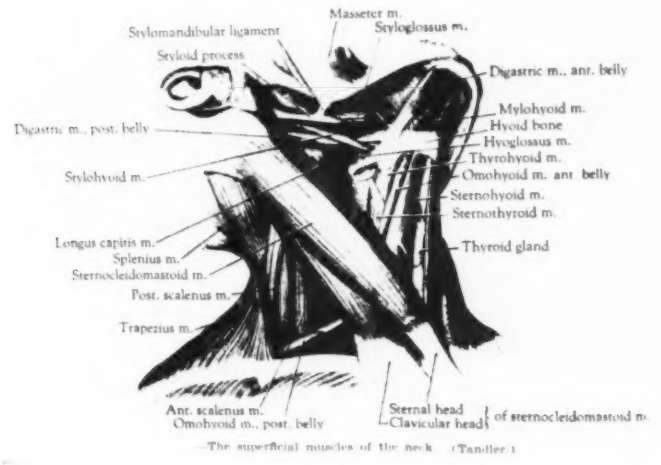
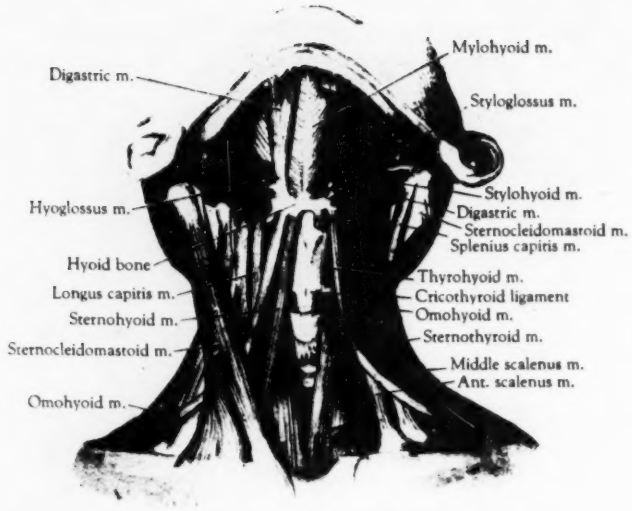


Fig. 2 — Suprahyoid musculature. (From Oral Anatomy. Courtesy of Harry Sicher and C. V. Mosby Co.)

—The superficial muscles of the neck. (Tandler.)



—Infrahyoid muscles, anterior view. (Tandler.)

Fig. 3—Infrahyoid musculature. (From Oral Anatomy. Courtesy of Harry Sicher and C. V. Mosby Co.)

OBJECTIVE SYMPTOMS—In case of a fracture of the hyoid bone, increased mobility and crepitus are observed in the region over the bone; these symptoms are accompanied by severe ecchymosis, edema and swelling. The throat and pharynx are inflamed.[11, 13, 14] Emphysema, with air in the fascial planes, can push the swelling as low as the mammillary line.[15] Palpation over the region elicits excruciating pain and tenderness.[12]

■ *Complications and Prognosis*

In the earlier reports in the literature, a fracture of the hyoid bone, complicated by a fracture of the mandible or of the thyroid or the cricoid cartilages, had a rather grave prognosis. Since 1900, the mortality rate has decreased, and prognosis for recovery from this type of fracture has steadily improved, until today it would indeed be a rarity to find the cause of death listed as a fracture of the hyoid bone.

Complications from fractures of the hyoid bone and associated structures do exist, however; they can be classified as follows:

1. Dysphagia. Dysphagia prevents the ingestion of food and necessitates feeding the hospitalized patient through a stomach tube.

2. Difficulty in respiration. Difficulty in respiration is a complication

13. Campbell, D. Fractura ossis hyoidei. Times and Register of Philadelphia 27:51, 1894.

14. Hamilton, F. H. Fracture of the hyoid bone. Buffalo M. J. 13:131, 1857-1858.

15. Kleinberg, S. Fracture of the hyoid bone. Ann. Surg. 99:547 March 1934.

which may become severe enough to require a tracheotomy to save the patient's life. Trauma, as a rule, causes a great amount of swelling in the neck, which further impedes respiration. This swelling, added to the edema of the glottis, may make the use of a general anesthetic by means of endotracheal intubation a risky procedure and thus delay surgical repair.

3. Comminution and displacement. Comminution and displacement of a fragment of bone in the pharynx may cause severe hemorrhage and emphysema.

4. Injury of the larynx. Injury of the larynx may lead to permanent voice injury.

5. Infections. Infections in the larynx and the upper respiratory tract, such as bronchial or lobar pneumonia, have terminated fatally, especially prior to antibiotic chemotherapy.

6. Sequestration. Complete sequestration of the hyoid bone has been reported by Winslow.[11]

■ *Sites of Fracture*

The most common site of fracture of the hyoid bone is at the junction of the body of the bone with the greater horns. The greater horn, however, may be fractured anywhere in its extent, but the fracture usually occurs close to the tip. Fracture of the body of the bone has been reported in cases of strangulation.[2] No cases could be found where the lesser horn was fractured.

■ *Treatment*

Most authors, including those as far back as 1856, agree that there is little to be done for hyoid bone fractures as far as definitive procedures are concerned. From the cases reviewed, the treatment may be summarized as follows:

1. Fragments are brought into as close approximation as possible by intraoral and extraoral manipulations. A fragment which has perforated the pharynx and extends into it may have to be resected or repositioned.

2. Rest in bed and good supportive treatment are helpful; the head should be placed in a fixed position, and cold packs should be applied to the neck to reduce swelling.

3. Radical procedures are indicated when there are tumors[11] or when persistent thyroglossal duct cysts recur. In such cases, surgical removal of the hyoid bone is indicated.[16]

4. The time required for cessation of symptoms and establishment of fibrous union varies from one to two weeks.

■ *Report of Case*

A man, 45 years of age, was admitted to the emergency room with bilateral mandibular fractures and multiple lacerations and contusions sustained in an automobile accident. The patient's chief complaint was severe pain in the jaw and in the neck with difficulty in swallowing. There was considerable edema in the neck. Roentgenograms revealed bilateral mandibular fractures with a distal displacement on the right side. A fracture of the right horn of the hyoid bone also was revealed (Fig. 4, left), which gave rise to the symptoms of pain, swelling and dysphagia.

16. Chiarolanza, R. Le recidive postoperatorie nella cura chirurgica delle fistole del tratto tireo-glosso. Arch. ital. di chir. 5:331 July 1938.

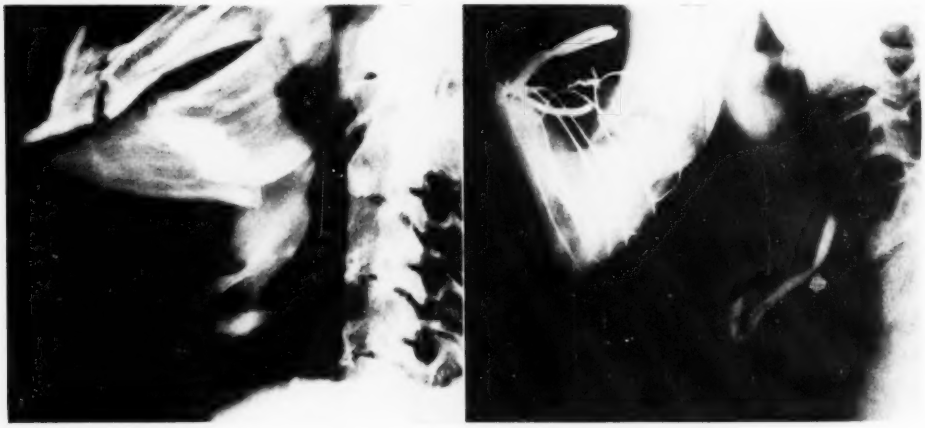


Fig. 4—Left: Fractures of mandible and greater horn of hyoid bone. Note long styloid process. Right: Circumferential wiring

Because the patient suffered severe pain on opening his mouth and it was considered inadvisable to use a general anesthetic without endotracheal intubation, the fractures of the mandible were reduced under local anesthesia by the use of bilateral lidocaine mandibular blocks and cutaneous and mucosal infiltrations, supplemented by 200 mg. of intravenous meperidine in divided doses and d-tubocurarine as a muscle relaxant.

A previously constructed acrylic splint was placed with circumferential wiring. The fracture of the hyoid bone needed no manipulation, as the fragments were in close apposition (Fig. 4, right).

Postoperative care was routine. The patient improved rapidly, and was released from the hospital on the seventh hospital day.

■ *Summary*

1. A review of the literature shows that fractures of the hyoid bone are rare.

2. When fractures of the hyoid bone do occur, they are often associated with fractures of other bones and complicate treatment. The diagnosis of fracture of the hyoid bone is often difficult because the symptoms may be obscured by traumatic fractures of the jaws and by swelling of the associated structures.

3. The oral surgeon must always consider the possibility of asphyxia and must recognize the indications for a tracheotomy.

4. Edema of the neck, caused by fractures of the hyoid bone, often makes it impossible to employ endotracheal anesthesia for oral surgical procedures.

Bilateral giant cell tumors of the mandible in siblings: *report of cases*

■ *Dan E. Brannin,* D.D.S., M.S.D., Tulsa, Okla., and Ralph O. Christensen, D.D.S., Minneapolis*

Central giant cell tumors present a complex problem. The relationship or lack of relationship of these growths to the lesions occurring in fibrous dysplasia of bone, to the osseous lesions occurring in hyperparathyroidism or to eosinophilic granuloma of bone has not been established. Further complicating the picture are occasional reports of familial, even hereditary incidence.[1,2] As a result there is disagreement and confusion concerning the proper terminology for these lesions.

Central giant cell tumors occur infrequently. They originate, in most instances, in the metaphyses of long bones. The bones most frequently involved are the femur, tibia, fibula and humerus.[3] Approximately 11 per cent occur in the jaws.[4] The age group between 15 and 25 is afflicted most frequently and the lesions occur with equal frequency in male and female.

Cooper is given credit for having first described in 1818 the benign nature of the giant cell tumor.[5] Since that time there has been considerable investigation and speculation concerning the real nature of these growths. Jaffe, Lichtenstein and Portis[6] interpret giant cell tumor as a neoplasm of a definite kind arising from undifferentiated supporting connective tissue of the marrow and easily capable of identification on the basis of its cytologic details. They emphasize the stromal cell as the most important constituent. In addition, they classify giant cell tumors into three grades on the basis of the microscopic characteristics of the stromal cells. Those in grade three in the classification are considered to be malignant.

Thoma also considers these growths as separate pathologic entities.[7] He states that they must be distinguished from osteoclastomas that occur in generalized osteitis fibrosa resulting from hyperparathyroidism. Weinmann and Sicher[8] prefer to avoid the term tumor in describing these lesions and instead suggest the terms "giant cell nodes" or "brown nodes." They attribute the origin of the giant cells to osteoclastic action and explain the persistence of giant cells on the basis of latent hyperpara-

*Graduate student, department of oral surgery, School of Dentistry, University of Minnesota.

1. Waldron, C. A. Familial incidence of bilateral giant-cell tumors of the jaw. Oral Surg., Oral Med. & Oral Path. 4:198 Feb. 1951.

2. Jones, W. A., and Gerrie, John. Cherubism, a familial fibrous dysplasia of the jaws. Oral Surg., Oral Med. & Oral Path. 5:292 March 1952.

3. Bell, E. T. Textbook of pathology, ed. 6. Philadelphia, Lea & Febiger, 1949.

4. Bernick, Sol. Central giant cell tumors of the jaws. J. Oral Surg. 6:324 Oct. 1948.

5. Coley, B. L. Neoplasms of bone and related conditions; their etiology, pathogenesis, diagnosis and treatment. New York, Paul B. Hoeber, Inc., 1949.

6. Jaffe, H. L.; Lichtenstein, Louis, and Portis, R. B. Giant cell tumor of bone. Arch. Path. 30:993 Nov. 1940.

7. Thoma, Kurt. Oral pathology, ed. 2. St. Louis, C. V. Mosby Co., 1944.

8. Weinmann, J. P., and Sicher, Harry. Bone and bones. St. Louis, C. V. Mosby Co., 1947.

thyroidism. Willis[9] considered the growths to be identical to osteoclastomas. He stated: "The giant cell tumor of bone arises from and consists of bone formative cells, which possess the attributes of osteoclasts." Geschickter and Copeland[10] held much the same belief. They stated that the growths resulted from an abnormal hyperplasia of osteoclasts at a site of intracartilaginous bone formation.

Despite the lack of unanimity concerning the origin and classification of central giant cell tumors, the microscopic characteristics of the lesion are well known to pathologists. The stroma consists of thin collagenous and precollagenous fibers. Numerous round or spindle-shaped cells which closely resemble young fibroblasts and undifferentiated mesenchymal cells are found throughout. Most striking at first glance is the presence of numerous multinucleated cells of varying size and shape which are more or less evenly distributed in the growth. The lesion is vascular with proliferating endothelial tissue and capillaries. Extravasated blood is frequently found and the reddish brown color of the lesion is attributed to the hemosiderin that is formed when the erythrocytes disintegrate.

The familial occurrence of bilateral giant cell tumors of the mandible is rare. Waldron in February 1951 reported this unusual phenomenon occurring in two sisters and later in the daughter of the elder sister.[1] Jones and Gerrie[2] in March 1952 described a family in which three members were affected by a peculiar bone dystrophy which involved the maxillae and mandible of each patient. Photomicrographs of Jones' cases revealed some giant cells in the medulla; however, there was an absence of giant cells at the periphery of the specimen. In the present report, two members of a family will be described who had bilaterally occurring giant cell tumors of the mandibular third molar region.

A seven year old boy and his ten year old sister came to the office February 6, 1951 after referral by their dentist. They were accompanied by their mother who stated that the children had growths in their jaws.

Approximately one week previously a school nurse had noted that the girl's first permanent molars had failed to erupt and she had advised consultation with a dentist. The mother detected an asymmetrical appearance of the lower part of the boy's face and she took both children to their family dentist who made intraoral roentgenograms which revealed large radiolucent areas in the mandibles of both children.

CASE 1—The seven year old boy had a history of repeated hospitalizations for uncontrolled diabetes, episodes of severe gastrointestinal bleeding and pneumonia. Until the age of two and a half he had been exceptionally healthy. At that age he had developed polyuria and polydipsia and suffered loss of weight. A diagnosis of diabetes mellitus was made and since that time the diabetes had been extremely hard to control. When he was five and a half years old he experienced two episodes of severe gastrointestinal bleeding. A provisional diagnosis of congenital telangiectasis of the bowel was made.

Study of the family history revealed that diabetes mellitus was found to have been the cause of death, or had been contributory thereto, of the paternal grandmother and of two first cousins of the mother. No members of the family had had any known abnormalities of the jaws. A five year old brother had no demonstrable abnormalities of physiology or anatomy.

EXAMINATION—The patient was an alert and cooperative well-developed, well-nourished seven year old boy. His cheeks were full, but there were asymmetrical bilateral swellings along the inferior border of the mandible. The right side was enlarged more than the left. These enlargements were firm and nontender and shotty in nature.

Intraorally a bilateral firm tumescence was present in the mandibular molar and retromolar regions. None of the mandibular molars were visible. The deciduous molars were crowded

9. Willis, R. A. Pathology of tumors. St. Louis, C. V. Mosby Co., 1948.

10. Geschickter, C. F., and Copeland, M. M. Tumors of bone, ed. 3. Philadelphia, J. B. Lippincott Co., 1949.

and irregularly positioned. The remainder of the oral cavity displayed no unusual findings.

Lateral oblique and anteroposterior roentgenograms of the mandible revealed large multilocular radiolucencies in both the right and left sides of the mandible (Fig. 1). The mandibular right first permanent molar and left first and second molars were involved in the lesions. There was no roentgenographic evidence of the mandibular right second and third molars or the left third molar. The osteolytic process extended well up toward the sigmoid notch, thus involving a considerable portion of the vertical ramus.

Physical examination supplemented by routine blood and urine studies revealed no additional positive data of note. Biopsy of each of the lesions resulted in a microscopic diagnosis of bilateral benign giant cell tumor of mandible.

An examination three months later revealed evidence of a radiolucent area in the right humerus. This was removed surgically elsewhere and it was reported as giant cell tumor.

TREATMENT—The boy was readmitted to the hospital on July 12, 1951 and after a painstaking examination in which no evidence of hyperparathyroid activity was found, he was declared ready for surgery. On July 18 the operation was performed under intravenous thiopental sodium-curare and orotracheal nitrous oxide-oxygen anesthesia.

An intraoral incision was made from a point just below the right coronoid process of the mandible, down the anterior border of the ramus, and along the crest of the alveolar ridge to a point anterior to the first deciduous molar where the incision was extended vertically to the mucobuccal fold. The mucoperiosteal flap thus outlined was reflected revealing an enlarged translucent bony membrane which was very friable. This was removed easily with osteotomes and rongeur forceps. An opening approximately 4 cm. by 2 cm. was made revealing a highly vascular, gritty, grayish tissue. This was removed with curets and with it the permanent first molar and second bicuspid teeth which were embedded in the lesion. The cavity was meticulously débrided of any remaining tissue and cauterized with Carnoy's solution. Petroleum jelly-iodoform gauze was packed loosely into the bony defect and the tissues were closed with no. 000 interrupted silk sutures leaving a 1 cm. opening in the central portion of the wound for subsequent dressing changes.

A similar procedure was carried out on the left side of the mandible three weeks later. After each procedure the patient suffered severe gastrointestinal bleeding episodes and multiple whole blood transfusions were required. The wounds in the mouth healed uneventfully. The dressings were changed every four or five days until the defects had reduced enough in size to allow mechanical cleansing with a water syringe after each meal.

Roentgenograms made approximately one year postoperatively demonstrated obliteration of the defects and development of normal supporting bone (Fig. 2).

CASE 2—The past health of this patient, in direct contrast to that of her brother, had been good. The mother had been told, however, that the girl was a latent diabetic.

The patient was an alert and cooperative

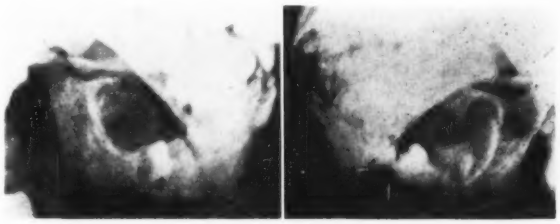


Fig. 1—Preoperative extraoral roentgenograms of Case 1 showing large tumorous growths in body and rami of the mandible

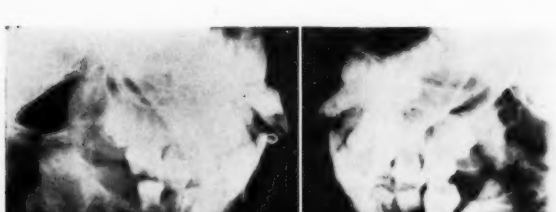


Fig. 2—Postoperative extraoral roentgenograms of Case 1 taken one year postoperatively showing obliteration of defects with roentgenographically normal supporting bone

well-developed, well-nourished ten year old girl of average size. Physical examination by an internist demonstrated no abnormalities other than those present in the oral cavity. There was an enlargement approximately 2 cm. in length and 1.5 cm. in width protruding buccally and occlusally in the right mandibular third molar region. A less noticeable enlargement was present on the left. These regions were firm and not tender to palpation. The right second and third molars were not visible nor were the first, second or third molars on the left.

Routine blood and urine studies were negative. Blood chemistry studies demonstrated alkaline phosphatase determinations of 19.5 King Armstrong units and 20.4 King Armstrong units. These were considered to be elevated but in view of the apparently normal calcium and phosphorus studies were not considered to be indicative of hyperparathyroid activity. A glucose tolerance test revealed responses which were interpreted as being those of a potential diabetic patient.

ROENTGENOGRAPHIC DATA — Periapical roentgenograms revealed radiolucent defects posterior to the mandibular first molars. There were no left second and third permanent molars, and the right third molar also was absent.

Lateral oblique views of the mandible demonstrated that the radiolucent lesions extended superiorly almost to the mandibular notch. They were sharply demarcated and circumscribed by a radiopaque border, ostensibly cortical bone (Fig. 3). Anteroposterior views of the mandible demonstrated no additional lesions or abnormalities.

Roentgenographic studies of the remainder of the skeleton were negative.

TREATMENT—On March 2, 1952 the right lesion was removed under intravenous thiopental sodium-curare and orotracheal nitrous oxide-oxygen anesthesia.

An incision was made extending from a point half way up the anterior border of the right mandibular ramus to the buccal side of the second deciduous mandibular molar, and from this point vertically to the mucobuccal fornix. The delineated mucoperiosteal flap was reflected exposing a somewhat bulging, grayish, bony membrane posterior to the permanent first

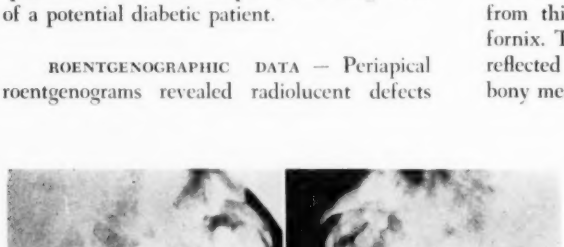


Fig. 3—Preoperative extraoral roentgenograms of Case 2 showing tumorous growths in the mandible that are remarkably similar to the growths in mandible of Case 1

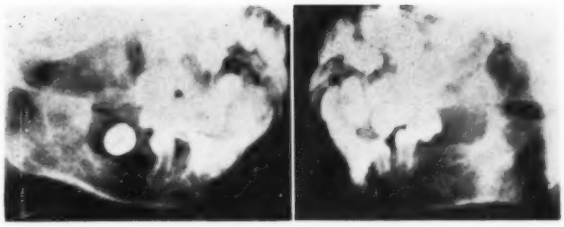


Fig. 4—Postoperative extraoral roentgenograms of Case 2 taken five months postoperatively showing obliteration of defects with roentgenographically normal supporting bone

molar. This friable bony membrane was opened using a chisel with hand pressure, and it was further enlarged with a blunt nose rongeur forceps. An opening approximately 1.5 cm. in diameter was made. Curets were employed to remove a jellylike, gritty, grayish, vascular tissue which extended posteriorly approximately 2 cm. and superiorly approximately the same distance in the ramus of the mandible. The tissue was seen to involve the socket of the mandibular first molar. This tooth and the second deciduous molar were extracted. After thorough curettage, a lobulated bony defect devoid of soft tissue remained. The walls of the defect were cauterized with a high frequency current. Absorbable sponge soaked in crystalline aqueous penicillin was placed in the superior portion of the defect. An analgesic guaze dressing was inserted in the inferior half of the wound and it was closed with no. 000 silk sutures leaving an opening through which it could be dressed. The specimen was submitted for microscopic study. The patient withstood the procedure well and was responding to commands when taken from the operating room.

On March 10 a similar procedure was carried out on the left side of the mandible. It was necessary to sacrifice the first permanent molar on this side in order to perform a complete enucleation of the lesion. The patient withstood this procedure equally well. She was seen every five days for change of dressings and inspection of the wounds. The defects granulated uneventfully and on April 8 the patient was furnished with a syringe and instructed to irrigate the regions after breakfast and before bedtime. She was referred to an orthodontist for treatment of the dental irregularities and was told to return for examination. The pathologist's report described the lesion as benign giant cell tumors.

Lateral oblique view roentgenograms of the mandible made five months postoperatively reveal obliteration of the defects and the presence of normal appearing bone (Fig. 4).

DISCUSSION—These two cases present an interesting subject for conjecture. The absence of the mandibular third molar buds in both cases, the right mandibular second molar in one, and the left second molar in the other, would seem to warrant the consideration of a possible etiology from an anomalous dental component. Long-term follow-up of these patients, their offspring, and the children of these offspring might provide data which could support a hypothesis of genetic predisposition. The presence of an additional lesion in the humerus of one of the patients would seem to indicate some etiological factor in addition to possible familial predisposition or dental origin.

Medical consultants ruled out hyperparathyroidism on the basis of laboratory and physical examination, but there is no certainty that these patients do not have a condition described by Weinmann and Sicher as latent hyperparathyroidism which may later become manifest.—*905 Medical Arts Building.*

Osteofibroma in the body of the mandible: *report of case*

■ *Joseph C. Tam, D.D.S., M.S.D., Minneapolis*

A white man, aged 36, was seen in the oral surgery clinic at the School of Dentistry of the University of Minnesota on October 29, 1948, because of a massive lesion in the left side of the body of the mandible. He was a short wiry person and appeared to be the type who worried about his health.

HISTORY—The lesion had been noticed first by a dentist 12 years previously at which time surgical treatment of the lesion was advised. Since the patient felt no pain or discomfort, however, the advice was disregarded. Eight years later a physician whom he consulted advised him to leave the lesion alone. On October 25, 1948, a dentist extracted the lower right first molar and immediately referred the patient to the School of Dentistry for consultation and treatment of the lesion. During this 12 year period, the lesion had grown slowly and was nonpainful.

PAST MEDICAL HISTORY—The past medical history indicated that the patient had had frequent watery diarrhea and insomnia. A physical examination in September 1947 had revealed that he had renal calculus. During the past year, he had noticed an intermittent burning sensation on urination.

EXAMINATION—The extraoral examination revealed a lesion ¼ of an inch in diameter overlying the right frontal bone. It was 1 cm. from the right eyebrow. The lesion was firm, hard and movable. On the left side of the face, near the inferior border of the mandible and about ¾ of an inch from the commissure, a slight swelling was visible (Fig. 1, left). When his mouth was opened wide, the swelling was prominent.

On intraoral examination, the lips, throat and palate were found to be negative. The tongue was coated and fissured, and the teeth were discolored with a dark brown stain. His maxilla was edentulous and the lower right and left first molars were missing. There was extensive abrasion of the incisal edges of the lower anterior teeth.

The massive lesion in the left side of the mandible extended from the cuspid to the second molar. The lesion measured 3.5 cm. long and 2.5 cm. wide. A shallow ulceration about 4 mm. by 3 mm. was seen on the surface of the lesion. This ulceration probably was due to trauma from the upper denture. Just lingual to this ulceration, a whitish cornified area measuring 4 by 4 mm. was present. The lesion, oval in shape, was hard, bony, firm and nonmovable (Fig. 1, right). On the lingual surface at the inferior border of the mandible, the lesion was palpable and tender to touch. This was also true externally at the inferior border of the mandible. No submaxillary or sublingual nodes on the left side were palpable. On the right side, a lymph node was palpable and measured about 8 mm. in diameter. The node was firm and movable.

LABORATORY FINDINGS—The urinalysis was negative. There was 15.7 Gm. of hemoglobin per 100 cc. of blood and the white blood count was 12,000 per cubic millimeter of blood. The erythrocyte sedimentation rate was 7.5 mm. in 60 minutes. The serological tests for syphilis were negative. A blood chemistry study revealed a calcium level of 2.3 mg. and an

Division of oral surgery, University of Minnesota School of Dentistry.

Fig. 1–Left: Extraoral view of lesion in left side of body of mandible. Right: Showing buccal extension of lesion

alkaline phosphatase level of five King-Armstrong units. There was 398 mg. of calcium excreted in a 24 hour urine calcium study. Pleural adhesions in the right diaphragm were evident in a chest photofluorogram. Roentgenographic study of the skull and jaws revealed an oval, well demarcated destructive lesion to be present in the left side of the body of the mandible. Its margins were eburnated and the central portion was partially rarefied and partly osseous.

The lesion was approximately 5 cm. long, extending from the cuspid to the third molar area and from the crest of the ridge to the inferior border of the mandible (Fig. 2, left). The occlusal roentgenogram revealed the buccolingual dimension of the tumor to be approximately 3 cm., the buccal and lingual cortical plates to be intact (Fig. 2, center).

The microscopic report of a biopsy taken on October 29, 1948, was "Fibro-osteoma or ossifying fibroma. Benign."

TREATMENT AND COURSE—On November 9, 1948, the patient was premedicated with 1.5 grains of pentobarbital and 10 grains of aspirin. The inferior alveolar, lingual and long buccal nerves on the left side were anesthetized with 2 per cent butethamine hydrochloride which contained 1:50,000 epinephrine. An incision was made through the mucoperiosteum medial to the lower left lateral incisor and was extended along the necks of the teeth to the lower left second molar. The buccal mucoperiosteal flap was raised with some difficulty since the

Fig. 2–Left: Radiopaque and radiolucent areas in central portion of lesion that are hazy in appearance because of embryonic bone trabeculae. Center: Lesion had not invaded buccal and lingual cortical plates. Right: Roentgenogram taken four years after operation. Lesion has not increased in size

periosteum was very adherent to the bony lesion.

Since it was felt that complete enucleation of the tumor would produce a pathologic fracture, it was decided merely to reduce its size. The height of the lesion on the buccal side was reduced with a chisel, rongeur forceps and bone rasp. The lesion beneath the thin buccal cortical plate was reddish and granular in appearance. After adequate reduction the wound was closed with two interrupted no. 000 silk sutures. The patient withstood the operation well.

Except for the usual complaint of swelling and tenderness, the immediate postoperative course was uneventful. A postoperative examination ten weeks later was negative. The patient was recalled again on January 23, 1953, at which time clinical examination and lateral jaw roentgenograms demonstrated that the lesion still had not increased in size (Fig. 2, right).

COMMENT—The case illustrates the need for a thorough diagnosis and the possible advantages of conservative treatment of an extensive benign lesion in the body of the mandible. Though the history, clinical findings, roentgenographic observations and biopsy pointed toward diagnosis of osteofibroma, blood chemistry studies were required to rule out hyperparathyroidism.

SUMMARY—Clinical and roentgenographic studies indicated that the lesion involved the left side of the mandible ranging from the cuspid to the third molar region. It was feared, therefore, that complete enucleation of the lesion would result in a pathologic fracture of the mandible. Such being the case, a conservative surgical reduction of the lesion seemed logical. This was done with gratifying results, for the examination made on a return visit four years later showed that further surgical reduction of the lesion was not needed.

Tooth in parapharyngeal space: *report of case*

■ *J. A. Harpman, M.S., F.R.C.S. (Edin.), Warwick, England*

A 20 year old girl was having an impacted right lower third molar extracted under regional local anesthesia. As the tooth was being eased upward and backward with an elevator it "turned turtle" and slipped into the tissues medial to the mandible. Figure 1, above, shows the position of the tooth as revealed by roentgenograms some hours later. The dental surgeon thought that the tooth lay between bone and periosteum. The day after the occurrence the patient complained of some pain in the right side of the face and exhibited trismus and some increase in temperature. Palpation, with the patient under general anesthesia, was uninformative; subperiosteal exploration of the inner aspect of the angle of the mandible revealed nothing abnormal there. Figure 1, below, shows the roentgenographic position of the tooth three days after the accident. The postero-anterior film, because of the downward tilting of the face, was of value only for determining the mediolateral position of the tooth. The trismus, discomfort and temperature were

Consultant ear, nose and throat surgeon, Warwick Hospital.

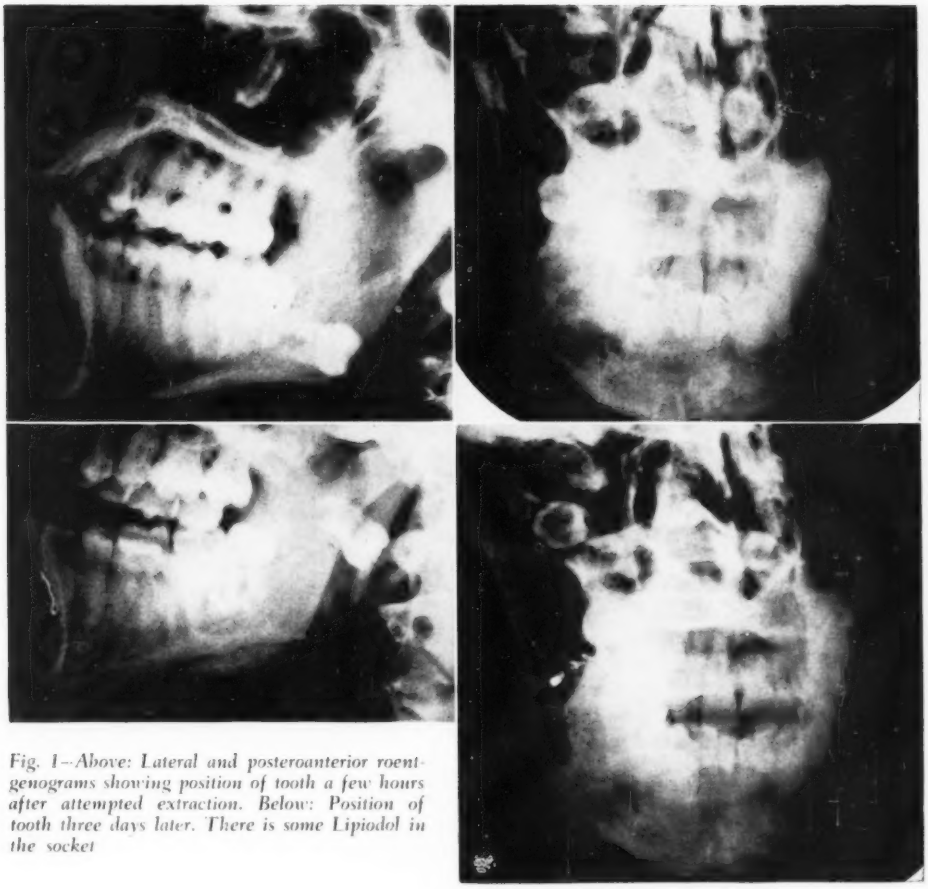


Fig. 1—Above: Lateral and posteroanterior roentgenograms showing position of tooth a few hours after attempted extraction. Below: Position of tooth three days later. There is some Lipiodol in the socket

worse, notwithstanding adequate intramuscular penicillin administration from the day of the extraction. Lipiodol was injected into the socket from which the tooth in question had been removed; the oil did not reveal a path to the tooth.

The symptoms, signs and roentgenograms were now interpreted as indicating that the tooth had slipped into the pterygopharyngeal space.

It was thought advisable to remove the tooth and drain the pterygopharyngeal space for fear suppuration there might have serious consequences. Three alternative surgical approaches were considered: (1) through the tonsil bed, after tonsillectomy; (2) through an incision in the posterolateral part of the hard palate, dissecting along the outside of the pterygoid hamulus; it is usual to dissect along the medial aspect of the upper part of the internal pterygoid muscle in this way in operations for the repair of cleft palate; (3) through the submaxillary region.

It seemed possible that more than one of these approaches might be required so it was decided to try them in the order named.

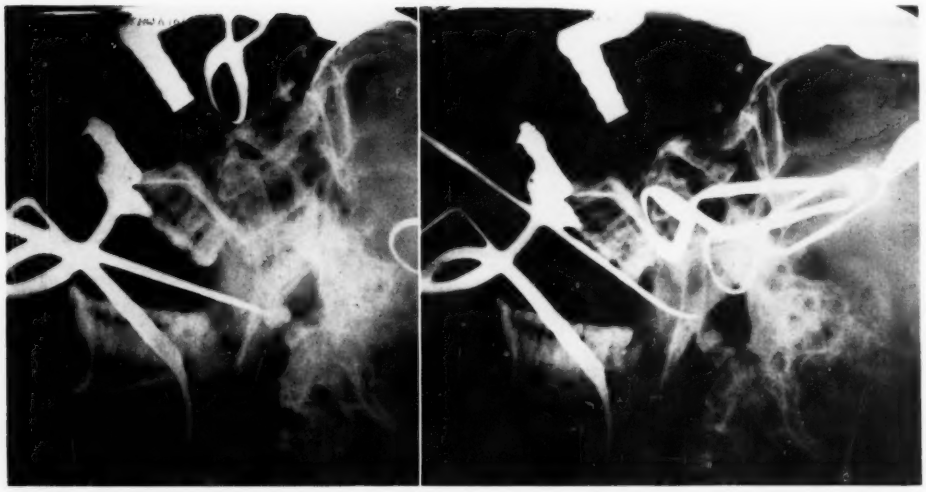


Fig. 2—Left: Localizing lateral view taken during operation. Right: Lateral view taken during operation showing tooth being dissected out of pterygopharyngeal space and from among fibers of internal pterygoid muscle

OPERATION—Under nasoendotracheal general anesthesia, the pharynx was examined. The right side of the soft palate was slightly edematous; the right tonsil was displaced inwards slightly and palpation of it revealed induration.

Tonsillectomy was performed on the right side. The tissues of the tonsil bed felt indurated but the tooth could not be felt. A probe passed upward and backward through the tooth socket entered the pterygopharyngeal space; the superior constrictor muscle and surrounding fascia were incised through the tonsil bed on to the probe and the space was thus entered. The space contained some indurated granulation tissue, but the tooth still was neither seen nor felt. Several lateral and anteroposterior roentgenograms were taken showing a forceps pointing to the site where the tooth was presumed to be (Fig. 2, left). Wider exposure was obtained by making an incision down to bone through the mucoperiosteum of the right posterolateral part of the hard palate. The pterygoid hamulus muscle was identified and by dissection lateral to this, the internal pterygoid muscle was identified and followed downward. A small quantity of foul-smelling pus was then encountered and evacuated; the tooth was found, just lateral to this pus, lying firmly embedded in the medial aspect of the internal pterygoid muscle. It had to be removed by working around it with a dissecting instrument (Fig. 2, right). The operation was surprisingly bloodless, perhaps because of septic thrombosis of the vessels.

COMMENT—Postoperatively, the wound presented the appearance of a rather extensive tonsillectomy, but it healed normally with no functional disability resulting. There was considerable discomfort and some trismus during the first few postoperative days, including discomfort in the tongue, probably the result of interference with the glossopharyngeal nerve which courses just deep to the tonsil bed on the stylopharyngeus muscle. Penicillin and streptomycin were administered intramuscularly during the first postoperative week.

Nevus of the gingiva: *report of case*

■ *Robert R. Allen, D.D.S., South Bend, Ind., and Karl W. Bruce,* D.D.S., Rochester, Minn.*

Nevi, or common moles, occur almost universally on the skin; however, their occurrence in the oral cavity is infrequent. The case reported herein is an example of a nevus on the buccal gingiva of a mandible.

Traub and Keil[1] classified nevi histologically as intraepidermal, intradermal, junctional (those at the dermoepidermal border), combination type and blue nevi. They judged the junctional (dermoepidermal) type to be the most hazardous in that it is more prone to develop into melano-epithelioma, which is the malignant counterpart of the benign nevus.

The intraoral nevus with which this case report deals corresponds in type to that of the intradermal nevus. Intradermal nevi usually are elevated, although they may on occasion be flat, and range in color from normal skin to any shade of brown depending on the amount of pigmentation. Intradermal nevi range in size from that of a millet seed to 1 cm. or more in diameter and usually present a smooth surface, although occasionally they are pedunculated and papillomatous.

Histologically, the intradermal nevus is characterized by the occurrence of nevus cells which can be identified by the fact that they give a positive reaction to dihydroxyphenylalanine (dopa). These cells may be arranged in clumps, nests, sheets or strands in the corium. These foci of nevus cells in an intradermal nevus are separated from the overlying epithelium by an uninvolved layer of fibrous connective tissue. The nevus cells are large, pale, and angular in shape with oval vesicular and often hyperchromatic nuclei and scant cytoplasm. The nevus cells may contain melanin or be entirely free of it. If they contain melanin, melanin-laden chromatophores are often present. Hair follicles may or may not be rather abundantly associated with intradermal nevi. The epithelium overlying intradermal nevi may be normal, but often it is flat because of the pressure of the tumor growth. In some nevi various types of epithelial hyperplasia can be noted with hyperkeratosis and parakeratosis being prominent.

Montgomery[2] stated that it is not practical to remove all moles, whether pigmented or not, since the percentage of moles undergoing malignant change is small. As a working rule he asserts that all moles, whether pigmented or not, occurring at sites likely to be subjected to trauma and irritation or any moles that are increasing in size or changing in pigmentation to blue-black should be removed. Montgomery[2] emphasized that moles should be completely eradicated by surgical excision and not partially removed by such methods as electrolysis, carbon-dioxide snow, and superficial cautery. He also pointed out that moles are resistant to roentgen and radium therapy, as are malignant melanomas.

■ *Report of Case*

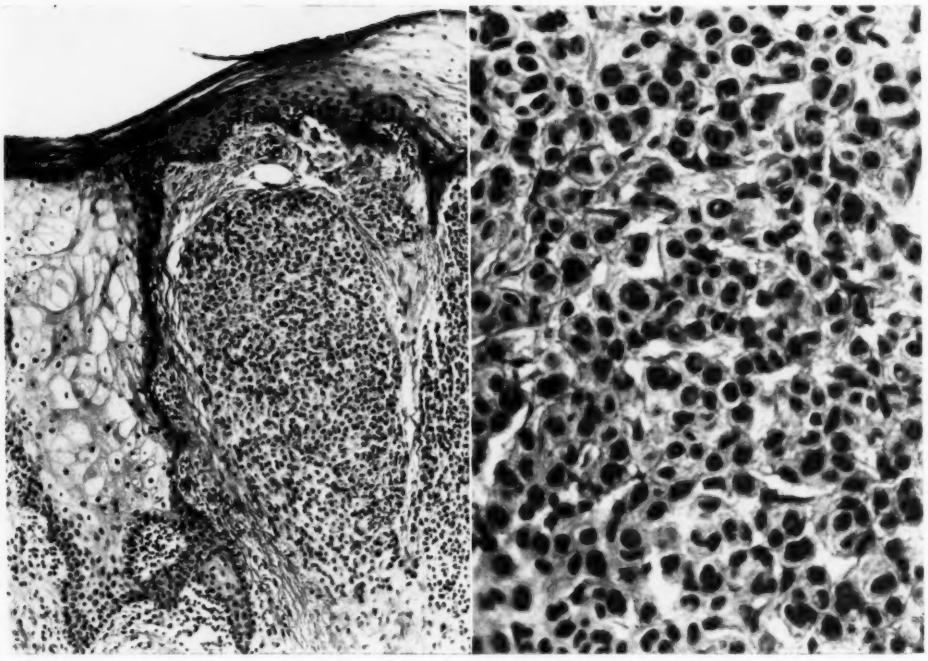
A white man, aged 53 years, reported to one of us (R.R.A.) for complete dental extractions because of generalized periodontal disease. All teeth with the exception of the four third molar teeth were present.

CLINICAL EXAMINATION—When the patient's mouth was examined, it was noted that there was a solitary brownish growth with a broad attachment situated on the buccal gingiva in the edentulous mandibular right third molar

*Section of dentistry, Mayo Clinic.

1. Traub, E. F., and Keil, H. "Common mole": its clinicopathologic relations and question of malignant degeneration. Arch. Dermat. & Syph. 41:214 Feb. 1940.

2. Montgomery, H. Pigmented nevi: differentiation and treatment. Modern Med. 18:87 Nov. 15, 1950.



Left: Low-power (×110) photomicrograph showing clumps of nevus cells in corium. There is a distinct band of connective tissue situated between the cluster of nevus cells and the epithelium. A hyperplastic rete peg can be seen dipping down into the corium. Parakeratosis and spongiosis are epithelial changes noted. Right: High-power (×435) photomicrograph showing plump angular nevus cells with clear cytoplasm. Some cells have rounded vesicular nuclei while others display hyperchromatic polygonal or narrow elongated nuclei

region. A clinical diagnosis of peripheral foreign body giant cell tumor was entertained. The mandibular third molar tooth had been extracted several years previously, and the dental roentgenogram taken at the time of this examination revealed a residual root in this region which was underlying the growth.

On January 10, 1952, the growth was excised intact with the patient under local anesthesia. It was noted at the time of operation that there was no attachment of the mass to the periodontal membrane of the residual root in the right third molar region or the periodontal membrane of the adjacent right mandibular second molar tooth, which were removed at the same sitting. Profuse bleeding was encountered on removal of the tumor mass. After excision the edges of the wound were approximated and sutured. The excised tumor mass, measuring 1 by 1.5 by 3 cm., was then submitted for histopathologic diagnosis. The postoperative course of the patient was uneventful.

MICROSCOPIC EXAMINATION—Microscopically, the sections of the tumor disclosed conspicuous groups of nevus cells situated in discrete nests in the upper part of the corium but separated from the basal layer of the overlying epithelium of the oral mucosa by a thin layer of fibrous connective tissue which did not contain nevus cells. This strip of fibrous connective tissue was thin in some regions but none the less present. The nests of nevus cells were separated from each other by bands of fibrous

connective tissue. The nevus cells did not dip down deep in the subjacent corium (illustration, left).

The nevus cells were plump, pale and polygonal with oval vesicular nuclei. The nuclei of some cells were hyperchromatic and angular. In some areas the nevus cells were tightly packed and small, and the nuclei were distorted and hyperchromatic (illustration, right). Some nests of nevus cells appeared to be undergoing atrophy and resembled foci of cellular fibrous connective tissue to some degree. Pigmentation was not present.

The overlying epithelium showed hyperkeratosis with intraepithelial keratinization (epithelial pearly bodies) in some areas. The rete pegs were elongated and parakeratosis was evident. Spongiosis was present in some areas.

On the basis of the microscopic findings a diagnosis of nevus (intradermal) of the gingiva was made. The patient has had no recurrence of the growth one year and five months after surgical excision was carried out.

■ *Comment*

A nevus occurring in an ectopic site on the gingiva is unusual. In discussing a lesion which is almost totally confined to the skin, such as is the nevus, terms which are applicable to skin have been employed and must be translated to apply to the mucosa and submucosa of the oral mucous membrane.

It is interesting to speculate on the etiology of nevi present in an ectopic situation as has occurred in the oral cavity of the patient reported. It is well known that ectopic sebaceous glands frequently are present on the buccal parietes and lips and less frequently on the alveolar gingiva. As such this situation is referred to as "Fordyce's disease." If sebaceous glands can be ectopically included in the oral mucosa from developmental origin, it would also seem reasonable to assume that a nevus which has begun to form on the embryonic skin surface prior to the rupture of the buccopharyngeal membrane or before the union of the facial clefts could similarly be ectopically dragged into the oral cavity and developed in this site. Should this theory be true it would necessarily follow that intraoral nevi would initiate their development in embryo. It would, however, be difficult to ascertain from the few cases of intraoral nevi seen that they did not, or could not, originate independently in mucous membrane any time after birth from either the epithelial or neuroepithelial source.

It is impossible to assess the importance of this lesion as a probable forerunner of melano-epithelioma. Intradermal nevi of the skin are not commonly thought to be subject to malignant degeneration. When this lesion appears in the mouth, however, where trauma is legion, the possibility of malignant change must not be forgotten.

Any circumscribed pigmented growth situated in the mouth which is clinically suspected or recognized as being a nevus, particularly if it is situated in a region which is subjected to daily trauma, should be surgically excised.—*404 West Jefferson Boulevard.*

■ A Dilemma of Science

Modern scientific education is presented with a well-known dilemma. The amount of facts in modern science, and in any of its smallest branches, is enormous. Life in general, and the academic curriculum in particular, is short. The abundance of factual data, as well as the intricacy of modern scientific techniques, experimental and theoretical, necessitates utmost specialization. This specialization, unavoidable though it is, involves serious danger for both the education of the scientist and the social function of science.—*Ludwig von Bertalanffy, "Philosophy of Science in Scientific Education," The Scientific Monthly, 77:233 November 1953.*

Clinical research in oral surgery

THE FIELD OF EXODONTICS has developed rapidly over the past 15 years, and the changes have been so great that it is difficult for the neophyte to appreciate fully the difficulties and dangers that at one time were always present. The ever present specter of infection, with its frequently serious prognosis, the high percentage of socket complications, and the dangers of poorly administered general anesthesia are but a few examples of previous difficulties which largely have been overcome. Much, however, remains to be done.

The effectiveness of antihistamines in reducing many undesirable postoperative sequelae appears to lead the way into new fields of endeavor. Additional research into the problem of tissue response to surgical trauma, and into the blocking of the undesirable portions of this response by antihistamines, ACTH, cortisone or hydrocortisone will do much to reduce postoperative reactions to a minimum. The role of the antibiotics as prophylactic agents, when administered locally or generally, is a subject of continuing interest and importance. It is generally acknowledged that, although the so-called "dry socket" is now a relatively infrequent occurrence, it still remains as a major annoyance on occasion. Additional research on the combined use of antibiotics with antihistamines, ACTH, cortisone or hydrocortisone may result in further improvement in this regard.

There have been favorable developments in general anesthesia, as administered for exodontic procedures. An example of such developments is the use of the short-acting barbiturates. It is still not without dangers and shortcomings; however, additional work in this field should do much to overcome these dangers. At present it appears that the combination of two or more anesthetic agents offers the best opportunity for future study and development, although new products that will be available in the future may direct developments in another direction. Clinical study of intravenous sedation, coupled with local anesthesia, may produce a technic outstanding in safety and efficiency.

It behooves all who are interested in this challenging and interesting portion of the field of oral surgery to be alert constantly for new medications, new procedures, and new concepts of treatment that will reduce undesirable sequelae to a minimum. Many clinical research problems can be carried on as efficiently in a private office as in a large teaching institution. Two of the requisites are a scientific curiosity and a desire to play a part in the development of oral surgery.—*Fred A. Henny.*

CLINICAL OBSERVATIONS

■ The discomfort of intraoral needle puncture can be diminished greatly by the use of a simple topical anesthetic which consists of 2.5 Gm. of tetracaine hydrochloride (Pontocaine) incorporated in 4¼ ounces of KY lubricating jelly. The flavor can be improved by the addition of two cyclamate sodium tablets (Sucaryl) and five drops of oil of peppermint. It is most effective when applied with a cotton applicator on a previously dried membrane and rubbed briskly for a period of 10 to 15 seconds. Needle puncture can be made immediately and usually it is accompanied by little or no pain.

■ Preoperative intravenous administration of barbiturates has the advantage of rapid effect and a relatively short recovery period, depending on the drug employed. Used in this fashion, the barbiturates provide a safe, efficient preoperative sedative prior to either local or general anesthesia. When heavy sedation is desired prior to local anesthesia, the barbiturates may be combined either with morphine or meperidine hydrochloride of average dosage.

■ Patients with cancer of the mouth usually display three cardinal local conditions:

1. Evidence of heavy use of tobacco.
2. Poor oral hygiene.
3. Evidence of local mechanical irritation.

In cancer of the tongue and floor of the mouth, these frequently are accompanied by serological evidence of syphilis. It is important, therefore, that a Wassermann blood test be included in the diagnostic study of suspicious lesions that occur in this region.

■ The topical application of hydrocortisone acetate (Hydrocortone Acetate) has proved useful in the treatment of many inflammatory lesions of the oral mucosa. It is most effective when the mucous membrane is first dried and the ointment rubbed into the affected region for a period of 30 to 60 seconds. The procedure should be repeated two or three times each day. Senile thinning of the mucosa with subsequent ulceration as well as many other chronic nonspecific inflammatory lesions respond promptly, but retain a good result only as long as medication is continued. No harmful effect has been noted from this type of treatment, although it is imperative that there be no evidence of gross infection in the mouth at the time that it is employed.

■ Resistant infections of dental origin frequently are of the enterococcal type. Since this group of organisms does not respond to penicillin therapy, the infection may progress actively in spite of vigorous antibiotic treatment. Enterococcal infections are sensitive to the combination of streptomycin and penicillin, however, and therefore usually respond rapidly to injections of this combination of drugs given twice daily. Because of the possibility of such resistant organisms being present at the time of extraction of teeth, it is wise to employ penicillin with streptomycin, which is available commercially in a combined form, in any prophylactic antibiotic therapy. This is especially true for individuals with a history of rheumatic fever or with evidence of rheumatic or congenital heart disease.

■ Metastasis from carcinoma of the lower lip usually takes place in an orderly progressive fashion and involves the submental, submaxillary and digastric nodes prior to extension into the deep cervical chain. In cancer of the tongue, however, metastasis typically involves the deep cervical nodes primarily. Since this group is well sheltered by the sternocleidomastoid muscle, it may be impossible to identify a palpable mass prior to rather extensive involvement. Metastasis also may be either unilateral, bilateral or contralateral and usually occurs at a relatively early stage of the disease as compared with metastasis from carcinoma of the lip.

Readers are invited to send their clinical observations to the editor, Fred A. Henny, Henry Ford Hospital, Detroit.

■ Persistent Hard Swelling

Q.—What causes a persistent hard swelling on the lateral surface of the mandible after the removal of impacted third molars?

A.—This sequela usually is caused by an organized hematoma beneath the periosteal surface when flaps have been reflected. The resorption of such a swelling is gradual and should not be of concern.

■ Fractured Fragment

Q.—When fracture of the buccal or lingual plates of bone occurs during the course of extractions, is it necessary to remove the fractured fragment?

A.—It is not necessary unless the fragment has lost more than one-half of its periosteum and the remaining soft tissue is not sufficient to cover and splint it. Blood supply, splinting and adequate suturing are of paramount importance.

■ Plasmacytoma of the Palate

Q.—A small nodular tumor was removed from the hard palate of a 45 year old woman, and the biopsy report identifies it as a plasmacytoma. What is the prognosis and what further treatment is recommended?

A.—This is a rare entity and additional diagnostic studies are indicated. This may, or may not, be a localized lesion. A skeletal roentgenographic survey for additional bone lesions and urinalysis for Bence-Jones proteinuria may detect changes of multiple myeloma. The microscopic appearance of the lesions of multiple myeloma and those of local plasmacytoma are identical. The prognosis of multiple myeloma is very poor. The vault of the palate is a rare location for the lesions of multiple myeloma. If these investigations indicate that an isolated lesion is present, the excision of the tumor should be adequate. This tumor is also treated satisfactorily by irradiation therapy.

■ Management of Leukoplakia

Q.—If several large areas of oral mucosa are involved by leukoplakia, what supervision and treatment should be rendered?

A.—After the removal of all possible factors of irritation in such cases, frequent and periodic observation is necessary. If the areas of leukoplakia persist and cannot be removed without significant deformity, they must be watched carefully with biopsy of any suspicious zone of change. Those changes which warrant biopsy are increases in thickness, fissuring, or ulceration.

■ Postextraction Infection

Q.—A case of unusual infection has been encountered recently after the removal of an abscessed lower molar. A very hard swelling over this region of the mandible has failed to subside over a four week period in spite of the use of sulfonamides and penicillin therapy. In the past several days two localized regions have become more inflamed and soft and have drained spontaneously. What treatment do you advise?

A.—Bacteriologic studies of the exudate should be carried out first in order to identify the

This section, devoted to queries and comments from readers on topics of current interest to oral surgeons and general dental practitioners, is edited by James R. Hayward, University Hospital, Ann Arbor, to whom readers are invited to send their communications. The answers, prepared by competent consultants, do not necessarily represent the opinions of any official scientific organization. Your participation in this section is invited.

The Editor.

organism. The clinical history suggests a mycotic infection, probably of actinomycosis type. If this diagnosis is substantiated by microscopic evidence through smear, culture, or biopsy, massive doses of chlortetracycline (Aureomycin) or similar antibiotic are indicated along with general supportive care.

■ Cold Applications in Infection Control

Q.—Is the application of cold useful in controlling spread of infection which complicates extractions?

A.—If there is definite evidence of a complication due to infection, the processes of defense as well as localization of the infection are more likely to be assisted by the use of heat than by the use of cold. Hot oral saline irrigations are of particular value in routine management of such cases.

■ Impacted Teeth with Undeveloped Roots

Q.—Impacted third molars with incompletely developed roots resist sectioning with a chisel and seem to require excessive bone removal. What procedure do you advise?

A.—Since the cushioning effect of the follicle makes chisel splitting ineffective, the division of the crowns of these teeth may be accomplished with bone drills in order to minimize the amount of bone removal required.

■ Hard Swelling in Floor of the Mouth

Q.—A patient complains of soreness in the floor of her mouth after wearing her new dentures for three weeks. The lingual flange has produced an ulcer near the midline. Beneath this region a very hard mass projects back in the floor of the mouth. Should this region be investigated by biopsy?

A.—The location of the mass and the history strongly suggest a prominent and calcified extension of the genial tubercles. An occlusal roentgenogram of the symphysis region of the mandible may confirm this impression. The denture flange then may be relieved in this area. If roentgenograms do not confirm this impression, biopsy certainly is indicated.

■ Severe Pain in Tongue

Q.—A 55 year old woman was referred to me for advice regarding spasms of excruciating pain in the left posterior of the tongue and anterior throat. She is without teeth and is unable to tolerate recently constructed dentures since the severe pain attacks her when eating. What are your suggestions regarding diagnosis?

A.—The history strongly suggests a major neuralgia or tic douloureux of the glossopharyngeal nerve. Although it is a rare neuralgia, the characteristic symptoms are unilateral paroxysms of pain in the region of the tonsil, posterior tongue and pharynx. Referral to a nuerosurgeon for evaluation and treatment is advised. Effective treatment often requires sectioning of the glossopharyngeal nerve root.

■ THE PHYSICIAN IN ATOMIC DEFENSE. By Thad P. Sears, M.D. 308 pages with 53 illustrations. Index. Price $6. Chicago, The Year Book Publishers, 1953.

This book is written for the purpose of instructing the physician in the nature of atomic energy and the effects it may produce on the body. The author has condensed a vast amount of information concerning the various forms of radiation and atomic energy, in both war and peace, in a brief and understandable manner.

He points out that in caring for victims of an atomic bomb attack dentists will be greatly needed, and should have some preliminary training in first-aid and emergency medical casualty care.

A discussion of atomic structure and the influence of radioactivity is followed by a description of isotopes, their methods of manufacture and their application to medical practice.

The author then outlines the nature of atomic bomb injuries and various types of protective therapy.

Final chapters cover methods of mass casualty care. As the number of physicians and nurses will be too few to care for the thousands of casualties following an atomic attack, the author points out that there will be need for auxiliary medical workers. These, he says, should be trained now.—*Russell W. Bunting.*

■ THE SURGERY OF INFANCY AND CHILDHOOD. By Robert E. Gross, M.D., D.Sc., and William E. Ladd. 1,000 pages with 567 illustrations. Index. Price $16. Philadelphia, W. B. Saunders Co., 1953.

This new volume on pediatric surgery constitutes a report of stewardship and a summary of progress at the Children's Hospital of Boston. Children's surgery is not limited to an anatomic region of the body and has little of the éclat which surrounds general surgery. With the gradual development of the surgical specialist, therefore, an infant in need of surgery may receive inadequate care in many a community. Those who operate on adults are not at their best when called on to operate on an infant. It takes more than diminutive instruments to be effective. Vitally necessary is a knowledge of special pathology and of the newer methods of correcting the underlying condition. Excessive mortality rates are always a concomitant of unpreparedness in surgical undertakings for children.

The author sums up his own vast experience in children's surgery. He makes objective appraisals of the results and evaluates the surgical procedures accordingly. The book is incomplete in spite of the extensive range of surgical entities considered. It lacks a discussion of many subjects which are a part of daily surgical practice.

Most valuable is the initial chapter on the preoperative and postoperative care so necessary in operations on any organ or tissue of the body. Of great help to the dental surgeon is the author's complete discussion of anesthesia in pediatric surgery. Discussion follows on all aspects of surgery in the various systems of the body except dental, neurosurgical, otolaryngologic and ophthalmological. Every entity is considered from all standpoints: etiology, pathology, symptoms, diagnosis, preoperative and postoperative procedures, therapeutic results and references. This is not the first book on pediatric surgery but is the best prepared to date.—*I. Newton Kugelmass.*

■ PHYSICAL CHEMISTRY FOR STUDENTS OF BIOLOGY AND MEDICINE. By David Ingersoll Hitchcock, Ph.D. Fourth edition. 266 pages with 31 illustrations. Index. Price $5. Boston, Little, Brown & Co., 1953.

Physical chemistry is here presented in four main divisions, the three forms of matter and their mixtures, the behavior of electrically charged particles, colloids and reactions. Though

written for those with only a working knowledge of algebra, the language of calculus is introduced and differential equations are unobtrusively given in scattered parts with no statement to the student that the equations are those of the calculus. New material has been added since the third edition, including new problems and 11 new figures with two being dropped. The 14 well designed appended experiments are rewritten from the previous text which listed 20. The two to four references to books, which terminate each of the 15 chapters, have been brought up to date. The general bibliography of the third edition has been dropped.

The text is descriptive of the frequently used equations instead of leaving the student to read primarily the language of mathematics though those so inclined to read, as does a mathematician, can do so. Aspects of practical biochemistry are discussed in the latter chapters which deal with colloids and equilibria in the blood. Biochemistry is also introduced to some degree in the experiments. There is no consideration of saliva which could be of interest to both students of medicine and dentistry.

The laboratory experiments are apparently designed for the use of a minimum amount of apparatus such as commonly available in university laboratories. They are well coordinated with the main text.—*Gerald J. Cox.*

■ Clinical Periodontology. By Irving Glickman. 1,019 pages with 742 illustrations. Index. Price $15. Philadelphia, W. B. Saunders Co., 1953.

This text is one of the best written on this subject and one of the most complete. It is divided into three sections: the normal periodontal tissues, periodontal disease, and clinical management or treatment of periodontal disease. The bibliography is extensive.

The reader is impressed by the completeness, thoroughness and clarity of presentation. The book is written in a systematic and interesting fashion.

Outstanding features include the 742 photographs, diagrams and roentgenograms, which are well chosen and clearly printed. Some of the especially well written chapters are: "The Principles of Occlusion and the Temporomandibular Joint," "The Oral Mucosa in Dermatologic Disease," "The Eradication of the Periodontal Abscss," "The Treatment of Bifurcation and Trifurcation Involvement" and "The Treatment of Gingival Enlargement." The chapter on "Sharpening of Periodontal Instruments" also is valuable. Treatment is well and capably presented.

Criticisms are few and relatively minor. It is surprising that the widely used electrosurgical method of periodontal pocket elimination is given so little space. A few of the subjects in the book are presented rather briefly. At times it seems that Dr. Glickman has overemphasized his work to the neglect of other researchers; however, that is his privilege.

Because of the intimate relationship of periodontics to all branches of dentistry, this book should be of great value to students and to all practicing dentists.—*Zar A. Reader.*

■ Experimental Hypnosis. Edited by Leslie M. LeCron. 480 pages. Index. Price $6. New York, Macmillan Co., 1952.

Leslie M. LeCron has done a splendid piece of work in bringing together, with appropriate editorial comments, the writings of some 18 authorities on hypnosis.

There are two excellent chapters by Burgess and Moss on the use of hypnosis in dental practice.

A careful reading cannot but impress one with the fact that there remains need for much more study and research in the field of hypnosis. The possibilities seem great indeed.

The book is marred, in this reviewer's opinion, by the inclusion of Whitlow's "Rapid Method of Induction." This violent and dangerous method in which the cerebral circulation is impaired has no place in dental practice. This shocking method has been used in stage shows, but that fact is no recommendation for the medical profession.—*Walter Hyde.*

■ Sur Le Traitement Du Prognathisme Mandibulaire (on the Surgical Treatment of Mandibular Prognathism). J. Levignac. Ann. d'oto-laryng. 70:31, 1953.

Various methods have been developed to eliminate recurrence of prognathism or open bite after certain types of surgery. Orthopedic surgery must involve no impairment and no changes except minor ones in muscular balance and function.

On that basis, there are grounds for criticism of the condyle resection method, which sacrifices normal joints and the function of the external pterygoid muscles. The Kostecka method of double osteotomy in cases of marked protrusion also is subject to criticism because it disturbs muscular balance of the jaw at rest or in motion and may cause recurrence of prognathism or open bite. In cases of marked protrusion, the Dingman procedure or the Ernst intraoral method, with a controlled type of reduction as performed by John W. Gerrie, is the preferred method.

■ Les Greffes En Chirurgie Maxillo-faciale (Grafts in Maxillofacial Surgery). Charles Freidel, P. Dumas and F. de Mourgues. Rev. de stomatol. 54:482 Aug.-Sept. 1953.

In a general survey by the Lyon group of surgeons on maxillofacial repair, emphasis was placed on recent trends and technics.

In his study on bone grafts, Freidel used refrigerated heterogenous bone graft to effect repair in case of loss of bone due to trauma, cancer, surgery or osteomyelitis of the jaw. Heterogenous bone was used successfully also as an onlay graft or as a filling for defects resulting from an intraoral approach in large cyst cavities.

A bone bank was organized. The grafts were taken by surgical and aseptic methods from the calf. They were kept in a freezer at -35° C. for a minimum of eight days. They could be used at any time afterward.

Dumas' work, which dealt mostly with cartilage grafts, shows the advantage of the use of preserved ox cartilage, which can be kept in a refrigerator at -5° C. in a saline and merthiolate solution and can be used at any time. The heterogenous graft, actually a foreign body, is well tolerated, easy to shape, and available when needed; it is also an ideal material for restoring contour.

De Mourgues' study dealt with skin grafts and flaps. Special emphasis was placed on methods of transfer such as skin tubes.

■ Relationship of Anesthesia to Post-operative Personality Changes in Children. James Eckenhoff. Am. J. Dis. Child. 86:587 Nov. 1953.

Over an 18 month period, questionnaires were mailed to the parents of all children admitted to the Hospital of the University of Pennsylvania for an otolaryngological operation. Answers were sought to the following questions: (1) Is your child a bed-wetter? Since the operation has he been wetting the bed? Does he wet it more frequently? (2) Does your child utter night cries or have night terrors? Since the operation has he been having night terrors? Does he have night terrors more frequently? (3) Is your child subject to temper tantrums? Since the operation has he been subject to tantrums? Do they occur more frequently? (4) Has your child become afraid of meeting strangers since the operation? (5) Has your child been afraid to have his face covered since the operation? (6) Has your child become afraid of new odors since the operation? (7) How did you prepare your child for hospitalization and the operation?

Two months after each operation, a letter containing these questions was mailed to the

parents. Replies were received from 612, or 61 per cent of the 1,008 parents to whom the letters were sent. Agents employed in the induction of anesthesia for the 612 patients were as follows: vinyl ether-ethyl ether for 363; nitrous oxide with cyclopropane ethyl ether or cyclopropane ethyl ether alone, 138; ethyl chloride-ethyl ether, 101; thiopental-nitrous oxide or thiopental-ethyl ether, 10.

Seventeen per cent of the replies indicated a personality alteration which might be traced to anesthesia and the hospital experience or to either alone. Thirty-two per cent of the changes reported concerned night cries or night terrors, occurring for the first time or becoming more frequent after hospitalization. Twenty-six per cent of the changes concerned temper tantrums; fear phenomena (fear of darkness, of unaccustomed odors, of strangers, or of having the face covered) constituted 23 per cent; and the remainder, 19 per cent, pertained to bed-wetting. The incidence of personality changes was highest in the youngest children. For young children the probability of undesirable personality changes was greater when the inductions were unsatisfactory (crying, struggling, vomiting and early obstruction) than when the inductions were smooth.

The percentage of personality changes was approximately the same with all induction agents (cyclopropane, ethyl chloride and vinyl ether), varying between 13 per cent and 17 per cent. A surprising observation was that 25 complaints related to bed-wetting, 23 for patients given vinyl ether and only 2 for patients given other agents. On a percentage basis, bed-wetting was five times more common after administration of vinyl ether for induction of anesthesia, in spite of the fact that there was no remarkable difference in other changes related to the anesthetic agent administered.

A previous report has demonstrated a clear-cut relationship between the type of preanesthetic medication and the incidence of crying prior to induction of anesthesia. It was shown that 35 per cent to 40 per cent of children 5 years of age or younger who received only atropine or scopolamine cried. Induction of anesthesia was always classified as unsatisfactory if crying occurred. It was shown further that the use of a barbiturate with the belladonna drug and careful attention to the time of the administration of the drugs significantly reduced the incidence of crying. It had been thought that personality changes were most likely to develop in a crying child. The data obtained supported this supposition. Therefore, careful attention to preanesthetic medication can reduce considerably undesirable sequelae.

Personality changes were observed in 16 per cent of young children for whom the induction of anesthesia had been satisfactory. Presumably, the number in this group could be reduced by more attention to home preparation, improved relationships between hospital personnel, parents, doctors and patient and possibly by more careful attention to preanesthetic medication.

Obviously, skill in the administration of the anesthetic remains of prime importance. For some children with personality changes, the induction of anesthesia was satisfactory, but medication was given too late or too early. It is possible that suppressed fears caused personality conflicts for some children, even though the children appeared cooperative and the induction was smooth. The results of this investigation have stimulated interest in a thorough study of the problem. An attempt will be made to begin a long-term study, utilizing the services of social workers and psychiatrists as well as anesthetists.—*Myron Kaufman.*

■ The Use of the Premaxillary Flap in the Repair of Bilateral Cleft Palate. Herbert E. Coe. Plast. & Reconstruct. Surg. 12:194 Sept. 1953.

Of the many problems involved in the repair of bilateral cleft palate one of the more difficult is that of the closure of the opening immediately posterior to the premaxilla. A method that differs from other procedures described in the literature is the employment of a flap from the posterior surface of the premaxilla.

The method is as follows: The usual lateral mucoperiosteal flaps are raised; and if they do not permit satisfactory closure of the anterior end of the cleft, the size of the remain-

ing defect is estimated, and a flap is laid out on the posterior surface of the premaxilla with its base at the nasal septum. This flap is from 3 to 5 mm. larger in all dimensions than the defect, and the location and size of the pedicle insure an excellent blood supply. The flap is reversed with its mucous surface toward the nasal cavity and held beneath the ends of the lateral flaps with suitable stitches used to bring the raw surfaces of all flaps in broad contact. The edges of the lateral flaps are then united over the raw surface of the premaxillary flap. This procedure does not provide for the closure of the alveolar clefts, which require separate treatment, either at the same time or at a later time; but in a high percentage of cases it does give a satisfactory closure of the troublesome opening.

A criticism of this method is that there is no union of the mucous surface of the flap to the base of the vomer, with the result that a communication is left between the nostrils near the anterior end. There is also lack of bony union between the premaxilla and the hard palate; although the premaxilla is firm in many cases, it is definitely mobile in others.—*C. Dean Couch, Jr.*

■ ABUSE OF RADIATION THERAPY. EDITORIAL. Paul W. Greeley. Surg., Gynec. & Obst. 97:640, 1953.

In spite of the fact that for years injuries to tissue have been observed after excessive exposure to radium or roentgen rays, the number of cases of chronic radiation dermatitis and necrosis appears to be on the increase. The use of roentgen-ray therapy by untrained individuals, overzealous treatment of cutaneous lesions, postoperative roentgen-ray therapy after inadequate surgery, improperly calibrated equipment and failure to get a proper history result in injuries to tissue which involve permanent damage.

The resultant injury is usually an endarteritis of the underlying vessels plus normal arteriosclerotic changes, resulting in a state of diminished local nutrition which makes breakdown inevitable. As in other cutaneous lesions associated with avascularity, chronic ulcerations and carcinomatous degeneration are not infrequent. The essential irreversible pathological change is obliterative arteritis or hyalinization of the vessels in the damaged region. Many chronic lesions finally degenerate into squamous cell carcinoma.

Because of the avascularity of the lesion, there is obviously little place for conservative management of this type of lesion. A successful permanent cure can be anticipated only when all damaged tissue has been excised into a region which has a good blood supply. Reconstruction calls for considerable judgment and experience on the part of the surgeon. More important than treatment of such lesions is their prevention.—*K. Tessler.*

■ TREATMENT OF BELL'S PALSY WITH CORTISONE. W. P. Robison and B. F. Moss. J.A.M.A. 154:142 Jan. 9, 1954.

Bell's palsy has been known for some time and may occur in persons of any age from infancy to old age; little or no progress in its treatment has been reported until recently.

There is much controversy over the etiology of this disease though several plausible theories have been advanced. The following conditions have been cited as possible causes: (1) specific infectious neuritis, (2) vascular dysfunction with secondary ischemia of the facial nerve, (3) refrigeration, (4) subclinical mastoid infection involving the region of the fallopian canal and (5) congenital stenosis of the fallopian canal associated with some precipitating factor.

Two cases of Bell's palsy occurring in children were treated with oral cortisone therapy and resulted in complete recovery in approximately two and a half weeks. Usually it requires months for patients to have relief.

According to Rothendler, the beneficial action of cortisone in these patients can be assumed to be due to a reduction of congestion and related ischemia of the nerve and its sheath in the body canal.—*K. Tessler.*

■ REVIEW OF THE TREATMENT OF MICROGNATHIA. William S. Kiskadden and S. R. Dietrich. Plast. & Reconstruct. Surg. 12:364 Nov. 1953.

Micrognathia in the newborn child and in the infant is characterized by a small, receding mandible, usually associated with a partial cleft of the palate and occasionally other anomalies. The lack of forward development of the mandible forces the tongue to lie in a posterior prolapsed position, resulting in respiratory obstruction and interference with swallowing. The only safe position for the baby is lying face downward so that gravity allows the mandible and tongue to drop forward and down to relieve the respiratory obstruction. The basic necessity is to seek relief from the mechanical obstruction produced by the tongue and thus to leave the respiratory tract open for ease in feeding and nursing. If this relief is provided, the clinical syndrome of micrognathia will be solved; with natural growth and gain in weight there should be sufficient forward growth of the mandible to bring the tongue out of the hypopharynx and to correct the functional and anatomical deformity.

The condylar growth centers are mainly responsible for the downward and forward growth of the mandible. Moderate normal variations in the forward position of the chin result from inherent genetic tendencies. Severe retrusion of the mandible in adults occurs only when the condylar growth centers are absent or have been injured during their normal growth period.

None of the factors which may inhibit mandibular growth were present in the infants observed in this study. Early roentgenograms showed only a small mandible and normal condyles. The reason for the lack of growth of the mandible during the fetal period has not been explained; but all evidence available from the literature and the experience of the authors indicate that the condylar growth centers can be expected to provide normal downward and forward growth during the early years of life to overcome the receding chin. The evidence so far obtained indicates that the progressive growth of the mandible of the micrognathic infant can be expected to correct the receding chin by the age of four to six years.

Pediatricians point out that lesser degrees of the syndrome are not uncommon and can be handled easily in the home by positioning and careful feeding; however, an infant who is having severe respiratory and feeding difficulties should be hospitalized immediately. If under adequate and vigilant nursing care the symptoms cannot be controlled, the operation of suturing the tongue to the lower lip, as mentioned by Shukowsky and fully developed by Douglas, should be performed. The indication for the time of surgery should be based on the amount of nursing care available, the degree and rapidity of gain in weight, severity of symptoms, and particularly the ability to control respiratory distress.

The Shukowsky-Douglas operation allows discharge of the child within seven to twelve days, depending on the gain in weight and the intelligent and cooperative assistance of the mother in the feeding. In this study the authors gradually came to the opinion that the tongue may be released in three months. It is quite possible that strength obtained through a gain in weight of two or three pounds may be sufficient for a youngster to gain control of his tongue so that an earlier detachment is possible; apparently, however, no harm results from this attachment if release is obtained before the lower teeth erupt.

In the 16 cases in this review there was normal development of the mandible, substantiated by roentgenograms and photographs of the patients.—*C. Dean Couch, Jr.*

Announcements

■ Society of Oral Surgeons Changes Meeting Place

The next annual session of the American Society of Oral Surgeons will be held in the Hollywood Beach Hotel, Hollywood, Fla., November 3-6, during the week preceding the 95th annual session of the American Dental Association. The change in meeting place was announced by Don H. Bellinger of Saginaw, Mich., Society president.

■ Harry Seldin Appointed Honorary Professor at Montreal

Harry M. Seldin of New York has been appointed honorary professor of the School of Dental Surgery of the University of Montreal. Dr. Seldin has lectured several years in the postgraduate section of the dental school. He has also served as a counselor to many University of Montreal students doing postgraduate work in the United States.

■ New York Oral Surgeons Honor Douglas Parker

Douglas B. Parker will be honored at the annual meeting of the Metropolitan-New York Society of Oral Surgeons scheduled for September 15 at the St. Albans Naval Hospital. Dr. Parker has been appointed professor of maxillofacial and oral surgery at Loyola University in New Orleans.

■ Leading Scientists to Participate in Panels at Annual Session

Leading scientists and well-known authorities will take part in the panel discussions scheduled for the Association's 95th annual session to be held in Miami, Fla., November 8-11, the Council on Scientific Sessions has announced. Panelists will discuss elastic impression materials, the effect of sugars and other carbohydrates on teeth, newer devices for cutting tooth structure and radiation hazards in the dental office.

For the first time the House of Delegates will not hold meetings in the headquarters hotel. It will meet instead in the Municipal Auditorium of Miami. The scientific exhibit will be housed in the Dinner Key Exposition Building in south Miami. As there are no hotels situated near the Exposition Building, special bus service has been arranged from Miami Beach hotels to downtown Miami and to the Exposition Building.

W. H. Campbell of Miami Beach, Fla., has been named head of the committee to plan the projected clinics. These clinics, in which the demonstrator will use visual aids such as slides to help in his presentation, are an innovation for the scientific program.

Association members who wish space in the scientific exhibit or in the motion picture program, stated Donald Washburn, director of the Scientific Exhibits, should have their applications filed at the Central Office before August 1.

The Association Housing Bureau opened April 1 at 320 N.E. Fifth Street in Miami and is accepting only those applications made on the official Association form.

■ Roentgenology Workshop to Present Latest Technics

The Second Annual Roentgenology Workshop will be held at the University of Washington School of Dentistry in Seattle July 17-19. The purpose of the Workshop is to present the latest advances in technics as well as to discuss problems encountered in practice. An evaluation of the use of roentgenology in the various fields of dentistry will be made.

Enrollment in the Workshop is limited to those who have participated in past workshops or who have attended accredited courses in roentgenology. Further information may be obtained from Wayne Gourley, 1007 Cobb Bldg., Seattle 1.

■ Commission Offer to Seniors Gets Good Response

The Navy Dental Corps has announced that for the present it will not need dentists from the Selective Service system. It will satisfy its need for approximately 300 dentists for the summer and fall months from the 1954 graduating class.

This action, stated Admiral Daniel W. Ryan, is the result of the excellent response from present senior dental classes to the Dental Corps' offer of commissions to those graduating from this year's class.

The Army and Air Force have also reported an excellent response from seniors to their commission offer.

■ J. Lorenz Jones to Head California Oral Surgeons

J. Lorenz Jones, Arthur E. Smith and John W. Wilson were elected president, president-elect and secretary-treasurer of the Southern California Society of Oral Surgeons for the year 1954.

■ December Date Set for Oral Pathology Examination, Board Elects Three Officers

The American Board of Oral Pathology will conduct an examination for certification December 12 in the laboratory of oral pathology, School of Dentistry, University of Pennsylvania, in Philadelphia. Inquiries about the examination may be addressed to the secretary of the Board.

At its annual meeting held in Chicago February 8 the Board elected the following to office: Henry M. Goldman, president; Joseph L. Bernier, vice-president, and Paul E. Boyle, secretary-treasurer.

■ Dental Roentgenography Film Ready for Distribution

The new motion picture *Hazards of Dental Radiography*, produced by the American Dental Association's Research Fellowship at the National Bureau of Standards, is ready for distribution. The film, available for viewing by professional audiences only, illustrates the elementary physics of dental roentgenography. It shows actual roentgenographic procedures in the dental office and points out the perils of repeated exposure of the dentist or his assistants to primary and secondary radiation. Safety recommendations are made.

The new film may be obtained from the A.D.A. Fellowship at the National Bureau of Standards in Washington, D. C., or from the Association's Central Office.

■ Council Accreditation of Specialty Training Favored

A total of 65 persons representing each of the specialty boards, the dental schools, the hospitals and the state boards of dental examiners attended the Workshop on Dental Specialties held March 10-12 at the Central Office.

The Workshop was sponsored by the Council on Dental Education for the purpose of finding solutions to problems confronting the specialty boards and those planning hospital and dental school specialty education programs.

Major conclusions reached by the group were: (1) all advanced educational programs for the dental specialties should be evaluated and accredited by the Council on Dental Education, (2) a uniform or similar system of record keeping should be used by the various boards and (3) an aptitude test might be given to prospective graduate students to assist the boards in counseling potential candidates.

■ Schools Offer Courses of Interest to Oral Surgeons

The University of Louisville School of Dentistry in cooperation with the Louisville General Hospital announces two six months' courses in general anesthesia for graduate dentists. Trainees have the same privileges as first year residents in anesthesia and are required to administer anesthetics for both major and minor surgery as well as for dental anesthesia.

On the student's completion of the course, the American Board of Oral Surgery may grant three months' credit toward the clinical requirements of the Board. The courses begin September 1, 1954, and March 1, 1955.

At North Carolina School of Dentistry, Chapel Hill, N. C., the graduate program is planned to meet the educational and experience requirements of the respective specialty boards. The programs lead to a Master's degree or a certificate. Students are admitted to the courses in orthodontics and pedodontics in June each year; admission for the study of oral surgery is scheduled for September.

■ Two Year Residency Offered By College

The College of Physicians and Surgeons announces a two year residency training program in oral surgery to be given in conjunction with the Stanford Service of the San Francisco Hospital. The salary for the junior residency will be $175 per month and for the senior residency $230 per month.

Further information may be obtained from the dean of the College, San Francisco.

■ Graduate Instruction in Oral Surgery to Begin in the Fall at the University of North Carolina

Graduate instruction in oral surgery at the University of North Carolina School of Dentistry will begin in the fall semester of 1954. The course will lead toward a Master's Degree or a certificate from the graduate school. The curriculum is designed to prepare dentists for the specialty practice of oral surgery, and requires a residency of two academic years and two summer sessions.

Clinical and laboratory facilities of the School of Dentistry, the North Carolina Memorial Hospital (600 beds) and Gravely Sanatorium (100 beds) are available to graduate students. The basic sciences will be taught in the several departments of the School of Medicine.

Further information may be obtained from the office of the dean, School of Dentistry, University of North Carolina, Chapel Hill, N. C.

Editorial communications

■ ORIGINAL COMMUNICATIONS—This journal invites concise original contributions in the broad field of clinical and experimental surgery of the mouth and associated structures, including roentgenology, diagnosis, anesthesia and oral surgical pathology. Articles are accepted for publication with the understanding that they are contributed solely to the JOURNAL OF ORAL SURGERY. All manuscripts are subject to editorial modification. Neither the editors nor the publishers accept responsibility for the views and statements of authors expressed in their communications.

■ MANUSCRIPTS—Manuscripts submitted for publication should be sent to Fred A. Henny, Editor, Henry Ford Hospital, Detroit, Michigan.

Manuscripts should be typewritten on one side of the paper only with double spacing and liberal margins. The author's name and the abbreviated title of the article should appear at the top of each manuscript page. The original should be sent to the editor and a carbon copy retained by the author. Manuscripts will not be returned if accepted for publication.

References should be placed at the end of the article and should conform to the style of the Quarterly Cumulative Index Medicus; viz., name of author, title of article and name of periodical with volume, pages, month and year. They should be numbered and should appear in the same order as that of the superior figures inserted in the appropriate positions in the text.

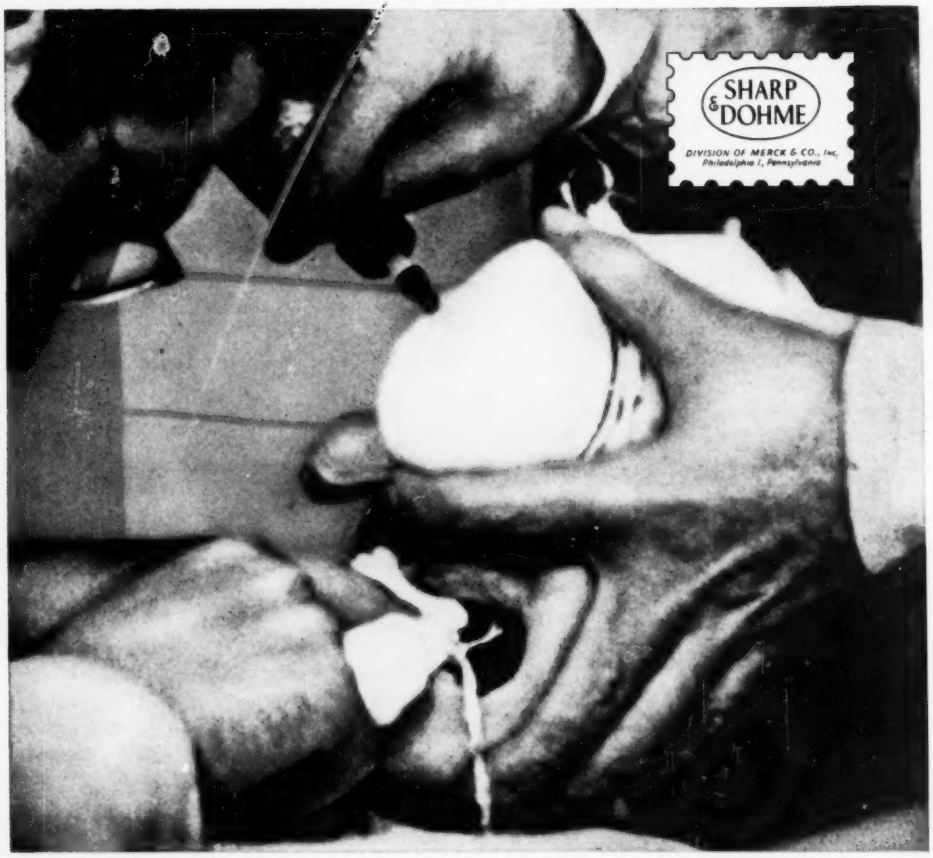
■ ILLUSTRATIONS—Illustrations accompanying manuscripts should be unmounted and numbered. The author's name should appear on the margin or back.

Authors should insert figure numbers at appropriate places in the text. The original drawings, or glossy print photographs of them, should accompany the manuscript. Legends for illustrations are to be typewritten in a separate list with numbers corresponding to those on the photographs and drawings.

A reasonable number of halftone illustrations will be reproduced free of cost to the author, but special arrangements must be made with the editors for color plates, elaborate tables or extra illustrations. Copy for zinc cuts (such as pen drawings and charts) should be drawn and lettered in India ink or with black typewriter ribbon (carbon paper placed with carbon against back of sheet for bolder type). Ordinary blue or colors will not reproduce. Only good photographic prints or drawings should be supplied for halftone work.

■ CASE REPORTS—Case reports will constitute an important department of the journal and the editors welcome case reports that are of unusual clinical value or that present exceptional conditions of interest.

■ EXCHANGES—Letters, exchanges, reprints and all other communications relating to the JOURNAL OF ORAL SURGERY should be sent to the American Dental Association, 222 East Superior Street, Chicago 11.



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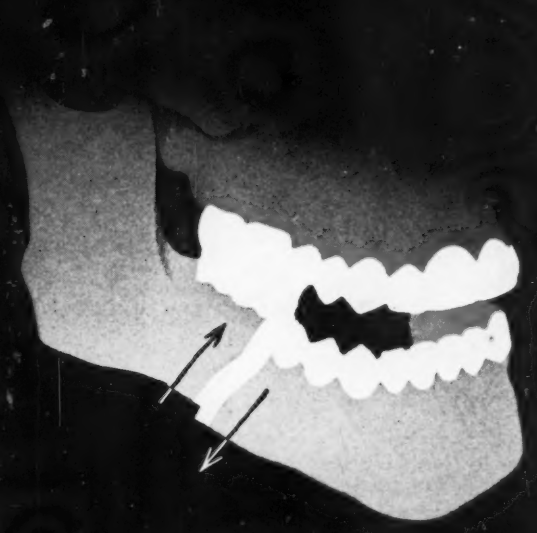

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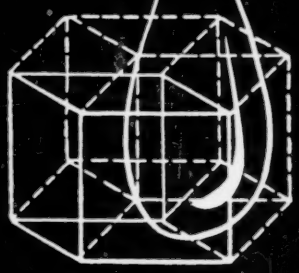

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† *Bragdon, C.: A Primer of Higher Space, New York, Alfred A. Knopf, 1923, Pate 1.*

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Hingson, R.A., N.Y. J. Dent., 30:370 (Oct.) 1950.

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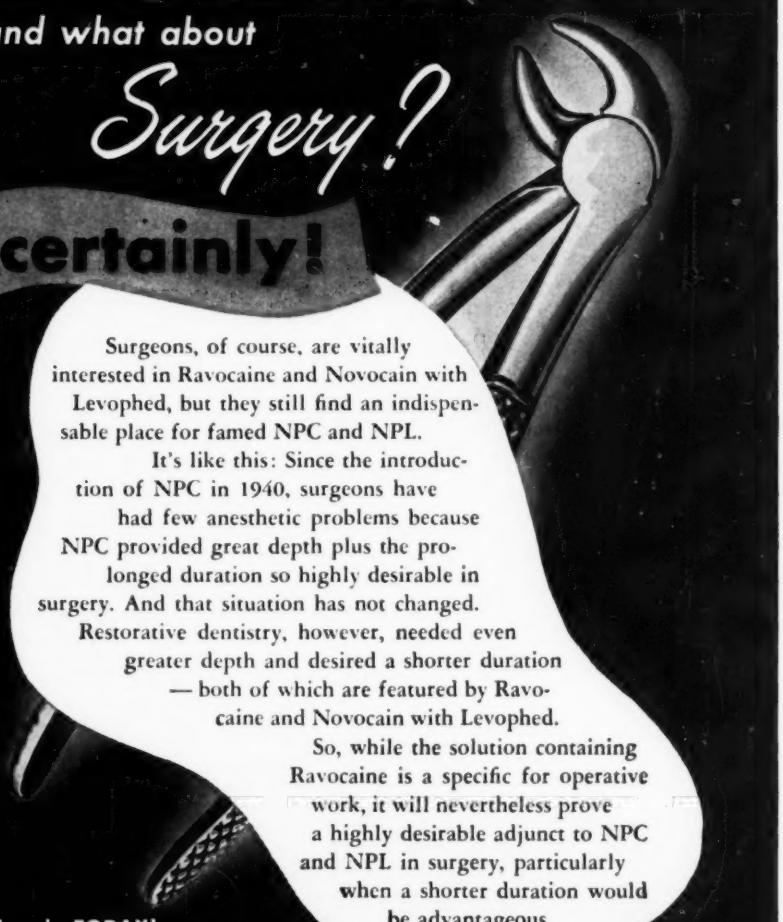

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